S-133-10

MINUTEMAN
WS-133 B

REQUIREMENTS AND DESCRIPTION

WING VI

VOLUME 3A

FIGURE A's

OPERATIONAL
AVE
OGE
RPIE

USAF AIR FORCE SYSTEM COMMAND
BALLISTIC SYSTEMS DIVISION

D2-30044-3A

THE BOEING COMPANY

CODE IDENT NO. 81205

NUMBER D2-30044-3A

TITLE WEAPON SYSTEM REQUIREMENTS AND DESCRIPTION, S-133-10 (U)

MODEL NO. WS-133B CONTRACT NO. AF04(694)-266

ISSUE NO. 133-1 ISSUED TO ASTIA

THIS ISSUE SUPERSEDES ISSUE ____

SPECIAL LIMITATIONS ON ASTIA DISTRIBUTION

ASTIA may distribute this report to requesting agencies subject to their security agreement, approved fields of interest, and the following:

☒ UNLIMITED—To all agencies of the Department of Defense and their contractors.

☐ LIMITED—To U. S. Military organizations only.

This report may be distributed to nonmilitary agencies not approved above subject to Boeing approval of each request.

NOTE: the LIMITED category may be checked only because of actual or potential patent, proprietary, ethical, or similar implications.

TECHNICAL PREPARATION BY AGE SYSTEMS ENGINEERING

DOCUMENT			
	PREPARED BY	WING VI DOCUMENTATION	
	SUPERVISED BY	W. J. Dempsey	2/15/3
	APPROVED BY	D. G. Stensrud	2/16/3
	APPROVED BY		
	CLASS & DISTR APPROVED BY	D G Stensrud	2/16/3
			(DATE)

DDC

REV SYM B

U3 4287 9035 ORIG. 8/62

VOL. NO. 3A OF 9

SECT. PAGE Title

of 382

2-81

2-19-3
3-25-3
5-15-3

S-133-10

MINUTEMAN
WS-133 B

REQUIREMENTS AND DESCRIPTION

WING VI

VOLUME 3A

FIGURE A's

OPERATIONAL

AVE

OGE

RPIE

USAF AIR FORCE SYSTEM COMMAND
BALLISTIC SYSTEMS DIVISION

D2-30044-3A

THE BOEING COMPANY

CODE IDENT NO. 81205

NUMBER D2-30044-3A

TITLE WEAPON SYSTEM REQUIREMENTS AND DESCRIPTION, S-133-10 (U)

MODEL NO. WS-133B CONTRACT NO. AF04(694)-266

ISSUE NO. 133-1 ISSUED TO ASTIA

THIS ISSUE SUPERSEDES ISSUE ____

SPECIAL LIMITATIONS ON ASTIA DISTRIBUTION

ASTIA may distribute this report to requesting agencies subject to their security agreement, approved fields of interest, and the following:

- [X] UNLIMITED—To all agencies of the Department of Defense and their contractors.
- [ ] LIMITED—To U. S. Military organizations only.

This report may be distributed to nonmilitary agencies not approved above subject to Boeing approval of each request.

NOTE: the LIMITED category may be checked only because of actual or potential patent, proprietary, ethical, or similar implications.

TECHNICAL PREPARATION BY AGE SYSTEMS ENGINEERING

DOCUMENT			(DATE)
	PREPARED BY	WING VI DOCUMENTATION	
	SUPERVISED BY	W. J. Dempsey	2/15/3
	APPROVED BY	D. G. Stensrud	2/16/3
	APPROVED BY		
	CLASS & DISTR APPROVED BY	D. G. Stensrud	2/16/3

REV SYM B

U3 4287 9038 ORIG. 8/62

VOL. NO. 3A OF 9

SECT. PAGE Title

of 382

2-5142

ACTIVE PAGE RECORD

SECTION	ORIG REL PAGE NO.	REV SYM	ADDED PAGES: PAGE NO.	REV SYM	PAGE NO.	REV SYM	PAGE NO.	REV SYM
	Title	B						
	A	B	B	B	C	B		
INTRO.	i	B						
	ii	B						
	iii	B						
	iv	B						
	v	B						
	vi	B						
	vii	B						
	viii	B						
	ix	B						
	x	B						
	xi	B						
	xii	B						
I			1	B	2	B	3	B
			4	B	5	B	6	B
			7	B	8	B	9	B
			10	B	11	B	12	B
			13	B	14	B	15	B
			16	B	17	B	18	B
			19	B	20	B	21	B
			22	B	23	B	24	B
			25	B	26	B	27	B
			28	B	29	B	30	B
			31	B	32	B	33	B
			34	B	35	B	36	B
			37	B	38	B	39	B
			40	B	41	B	42	B
			43	B	44	B	45	B
			46	B	47	B	48	B
			49	B	50	B	51	B
			52	B	53	B	54	B
			55	B	56	B	57	B
			58	B	59	B	60	B
			61	B	62	B	63	B
			64	B	65	B	66	B
			67	B	68	B	69	B
			70	B	71	B	72	B
			73	B	74	B	75	B
			76	B	77	B	78	B
			79	B	80	B	81	B
			82	B	83	B	84	B
			85	B	86	B	87	B
			88	B	89	B	90	B

SECTION	ORIG REL PAGE NO.	REV SYM	ADDED PAGES: PAGE NO.	REV SYM	PAGE NO.	REV SYM	PAGE NO.	REV SYM
I			91	B	92	B	93	B
			94	B	95	B	96	B
			97	B	98	B	99	B
			100	B	101	B	102	B
			103	B	104	B	105	B
			106	B	107	B	108	B
			109	B	110	B	111	B
			112	B	113	B	114	B
			115	B	116	B		
II	1	B						
	2	B						
	3	B						
	4	B						
	5	B						
	6	B						
	7	B						
	8	B						
	9	B						
	10	B						
	11	B						
	12	B						
	13	B						
	14	B						
	15	B						
	16	B						
	17	B						
	18	B						
	19	B						
	20	B						
	21	B						
	22	B						
	23	B						
	24	B						
	25	B						
	26	B						
	27	B						
	28	B						
	29	B						
	30	B						
	31	B						
	32	B						
	33	B						
	34	B						
	35	B						
	36	B						
	37	B						

ACTIVE PAGE RECORD

SECTION	ORIG REL PAGE NO.	REV SYM	ADDED PAGES					
			PAGE NO.	REV SYM	PAGE NO.	REV SYM	PAGE NO.	REV SYM
II	38	B						
	39	B						
	40	B						
	41	B						
	42	B						
	43	B						
	44	B						
	45	B						
	46	B						
	47	B						
	48	B						
	49	B						
	50	B						
	51	B						
	52	B						
	53	B						
	54	B						
	55	B						
	56	B						
	57	B						
	58	B						
	59	B						
	60	B						
	61	B						
	62	B						
			63	B	64	B	65	B
			66	B	67	B	68	B
			69	B	70	B	71	B
			72	B	73	B	74	B
			75	B	76	B	77	B
			78	B	79	B	80	B
			81	B	82	B	83	B
			84	B	85	B	86	B
			87	B	88	B	89	B
			90	B	91	B	92	B
III	1	B	2	B	3	B	4	B
			5	B	6	B	7	B
			8	B	9	B	10	B
			11	B	12	B	13	B
			14	B	15	B	16	B
			17	B	18	B	19	B
			20	B	21	B	22	B
			23	B	24	B	25	B
			26	B	27	B	28	B
			29	B	30	B	31	B
			32	B	33	B	34	B
			35	B	36	B	37	B

SECTION	ORIG REL PAGE NO.	REV SYM	ADDED PAGES					
			PAGE NO.	REV SYM	PAGE NO.	REV SYM	PAGE NO.	REV SYM
III			38	B	39	B	40	B
			41	B	42	B	43	B
			44	B	45	B	46	B
			47	B	48	B	49	B
			50	B	51	B	52	B
			53	B	54	B	55	B
			56	B	57	B	58	B
			59	B	60	B	61	B
			62	B	63	B	64	B
			65	B	66	B	67	B
			68	B	69	B	70	B
			71	B	72	B	73	B
			74	B	75	B	76	B
			77	B	78	B	79	B
			80	B	81	B	82	B
			83	B	84	B	85	B
			86	B	87	B	88	B
			89	B	90	B	91	B
			92	B	93	B	94	B
			95	B	96	B	97	B
			98	B	99	B	100	B
			101	B	102	B	103	B
			104	B	105	B	106	B
			107	B	108	B	109	B
			110	B	111	B	112	B
			113	B	114	B	115	B
			116	B	117	B	118	B
			119	B	120	B	121	B
			122	B	123	B	124	B
			125	B	126	B	127	B
			128	B	129	B	130	B
			131	B	132	B	133	B
			134	B	135	B	136	B
			137	B	138	B	139	B
			140	B	141	B	142	B
			143	B	144	B	145	B
			146	B	147	B	148	B
			149	B	150	B	151	B
			152	B	153	B	154	B
			155	B	156	B	157	B
			158	B	159	B	160	B
			161	B	162	B		

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	Completely revised document to reflect revision of OGE Figure A's.	3/22/3	
B	**Completely revised document to add AVE Figure A's and reflect revision of OGE and RPIE Figure A's.**	5/13/63	

TABLE OF CONTENTS
VOLUME 3A

* Partial data ; this information will be expanded in logical packages as developed and approved.

INTRODUCTION

A. PURPOSE

The Weapon System Requirements and Description Document presents a detailed functional description of the WS-133B Weapon System in accordance with Task 2.0 of the Statement of Work, contract AF04(694)-266. It provides source data for all agencies concerned with the development of equipment elements, facilities criteria, personnel and training requirements, technical manual data, provisioning data and logistics planning.

B. SCOPE

This volume contains the operational Figure A's developed during the system requirements analysis. This analysis was performed in accordance with AF/BSD Exhibit 62-62, utilizing the baseline, defined in Task 2.0 of the Statement of Work as a point of departure.

C. FORM B AND FIGURE A RELATIONSHIP

The equipment recommended on the Figure A has been derived from the functional requirements expressed on the Form B's and C_1's. Functional requirements of a like nature are grouped in logical packages to generate an end-item of equipment. The Form B - Figure A relationship is a closed loop technique wherein the process continues until all of the requirements are satisfied.

D. EQUIPMENT DATA FORM - FIGURE A

The Figure A provides a means for deriving equipment to satisfy the technical requirements identified on the Form B's & C_1. The Figure A has a dual purpose: (a) to derive operational equipment and (b) to define and substantiate end-items of equipment. An explanation of the information found on the Figure A is given below. (See illustration 1)

I. TECHNICAL REQUIREMENTS

This entry of the Figure A embodies the sum of the design criteria for the end-item of equipment. Herein are listed all numerical values, limits, ranges and tolerances imposed on the system design. The following items, as applicable, are included in the Technical Requirements.

A. Functional Requirements

Contains the engineering data for the requirements necessary to accomplish a given function (as derived from the Form B or C_1)

B. Design Constraints

The constraints are listed as applicable in one, several or all of the following topics:

1. Power
2. Physical
3. Interface
4. Environment
   a. Ambient
   b. Dynamic
5. Weapons Effect
6. Monitoring
7. Operating Life
8. Safety Considerations
9. Special Considerations

C. Operability and Maintainability

Covers any special features or requirements that contribute to operability or maintainability of the equipment.

D. Reliability

Reliability criteria (unless classified) is listed or referenced.

E. Applicable Documents

Lists the supporting documents used to derive the requirements and restraints.

II. RECOMMENDED SOLUTION

This entry presents a technical description of the recommended equipment that fulfills the technical requirements. The topic format is the same as that of the Technical Requirements, items A through E. Whenever necessary, the information is expanded to insure that the equipment reflects an accurate and comprehensive solution to the Technical Requirements.

■ TYPE OF LIST

The entries for this line are one of the following:

AVE	(Aerospace Vehicle Equipment)
OGE	(Operational Ground Equipment)
MGE	(Maintenance Ground Equipment)
RPIE	(Real Property Installed Equipment)
DT &TE	(Depot Tooling and Test Equipment)

■ MODEL DESIGNATION

SM-80 Weapon System (all entries)

■ SUBSYSTEM IDENTIFICATION

Entries for AVE, OGE or applicable RPIE Figure A denote the particular subsystem from which the requirements originate. Entries for MGE or applicable RPIE Figure A denote the particular subsystem that the requirements support.

■ CONTRACTOR

Entries identify the contractor responsible for the equipment or system.

■ FIGURE A NUMBER

This number identifies an item of AVE, OGE, MGE or RPIE recommended for procurement. The number is unique to the item of equipment involved. The same equipment with different applications is identified by separate Figure A requirements but the same number.

Wing VI Figure A Numbering

All Wing VI Figure A are identified as revision 6A, whether they are identical to WS-133A Figure A's, or new Figure A's. Subsequent revisions are identified by the wing number and revision code, thus: 6B, 6C, 6D etc.

WS-133B VAFB Figure A Numbering

If the equipment is identical to Wing VI equipment the same Figure A number is used and VAFB is added to the Basis of Issue column (P) of the Figure A. If the equipment has special technical requirements that result in a design modification, a separate Figure A is written with the Wing VI number and "Revision 6 AV". If WS-133A VAFB peculiar equipment is used, the WS-133A Figure A number with "Revision 6 AV" is added to the Figure A.

■ MILITARY NOMENCLATURE AND FEDERAL MANUFACTURERS CODE

Entries in this column list the military or accepted commercial nomenclature. The Federal Manufacturers Code is taken from cataloging Handbook H4-1.

■ COMMON NOMENCLATURE

This entry aids in differentiating between equipment of like nomenclature having different technical requirements and recommended solutions.

■ ORIGINATION DATE

Date of original preparation of the Figure A.

■ AFBSD APPROVAL DATE

Date of AFBSD contractural approval of the Figure A.

■ CONTRACT NUMBER

Applicable weapon system contractor number.

■ REVISIONS

1. Revision Date: official date of revision
2. Code: Alphabetical, progressing from A, B, C etc.
3. Initiated by: agency or vehicle authorizing the change.
4. AFBSD Approval Date: date of contractual approval.

■ FUNCTIONAL CLASSIFICATION INDEX

Functional code in accordance with USAF Bulletin 507A. This entry is not applicable to AVE Figure A's.

■ STOCK NUMBER

Entries to this column serve to identify the equipment by one or more of the following numbers.

1. Federal Supply Class
2. Federal Item Identification Number
3. Manufacturers Part Number

■ BASIS OF ISSUE AND QUOTA ALLOCATIONS

Entries in this column list the quantities of equipment recommended for each listed location. An "X" entered in the SMSA, SRA, or MAMS indicates usage but no quantity recommendation.

■ TOTAL ON ORDER

This entry lists the total of active and reserve quantities.

■ ESTIMATED UNIT PRICE

This entry is the best estimate of the contractor on the price of the Figure A item.

■ ESTIMATED TOTAL PRICE

This entry is the unit price times (x) total quantity.

■ COGNIZANT LAB CENTER AND SERVICE

This entry, as applicable, lists the symbol of the DOD agency or laboratory having engineering cognizance of the Figure A item.

■ PROPOSED SOURCE OF SUPPLY

This entry identifies the equipment as Government Furnished Property (GFP), or Contractor Furnished Equipment (CFE).

■ SOURCE CODE

Entries in this column identify the approved source of supply for the Figure A equipment (ie CFE, GFP).

■ ESTIMATED PRODUCTION LEAD TIME

This entry is the contractors total estimated development and production lead time in months. A single asterisk (*) denotes development time, and a double asterisk (**) denotes procurement of parts and fabrication. No asterisk indicates combined times.

■ END ITEM EFFECTIVITY

This entry identifies the specific Wing (ie W-6, W-7 etc) to which the equipment is applicable.

■ REMARKS

Entries in this column identify the source data from which the technical requirements and design restraints were derived. (ie Form B function number 1.2.X.X, and Form C_1 indentures).

TYPE OF LIST A	MODEL DESIGNATION B	SUB SYSTEM IDENTIFICATION C	CONTRACTOR D
FIGURE A NUMBER E / MILITARY NOMENCLATURE AND FED. MFR'S CODE F	COMMON NOMENCLATURE G	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO. K

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
L				M	N			P								Q	R	S	T	U	V	W	X	Y

I. TECHNICAL REQUIREMENTS

II. RECOMMENDED SOLUTION

(Refer to text paragraph D
for explanation of column entries)

ILLUSTRATION 1

SHEET ____ OF ____ NOMENCLATURE ____ FIGURE A NUMBER ____

2-6834-0-5

E. GLOSSARY OF ABBREVIATIONS

AFSC	Air Force Speciality Code or Air Force Systems Command
AGC	Aerojet General
AGE	Aero-Space Ground Equipment
AMA	Air Material Area
AN.	Autonetics
ATC	Air Training Command
AV	Avco
AVE	Aero-Space Vehicle Equipment
BOEING	The Boeing Company
BSD	Ballistic Systems Division
CEP	Circle of Equal Probability
CFE	Contractor Furnished Equipment
C/O	Checkout
DT & TE	Depot Tooling and Test Equipment
G & C	Guidance and Control
GES	Ground Electronics System
GFE	Government Furnished Equipment
GFP	Government Furnished Property
HPC	Hercules Powder Company, Magna, Utah
LCF	Launch Control Facility
MAMS	Missile Assembly and Maintenance Shops
MCC	Mobile Launch Control Center
MGE	Maintenance Ground Equipment
MLCC	Mobile Launch Control Center
NA	Not Applicable
OGE	Operational Ground Equipment

E. (Continued)

PA	Penetration Aids
PAS	Primary Alert System
PROP	Propulsion
RFI	Radio Frequency Interference
RPIE	Real Property Installed Equipment
R/V	Re-entry Vehicle
SAC	Strategic Air Command
SMSB	Strategic Missile Support Base
STL	Space Technology Laboratories, Inc.
SYL	Sylvania
SYL (W)	Sylvania (West)
TAPS	Trajectory Accuracy Prediction System,
TCC	Thiokol Chemical Corporation
T-R	Transformer - Rectifier
VAFB	Vandenberg Air Force Base
W/S	Weapon System

F. VOLUME INDEX

NOTE

All Volumes in the S-133-10 series are identified by a Boeing document number. The base portion of this number is D2-30044-. To obtain a given volume, add the volume number to the base number. (e.g. Volume 3A is Document No. D2-30044-3A).

F. VOLUME INDEX (CONT.)

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
AEROSPACE VEHICLE EQUIPMENT	SM-80 WEAPON SYSTEM	85001-306	AUTONETICS, A Division of North American Aviation, Inc.

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED MFR'S CODE (94756)	COMMON NOMENCLATURE	ORIGINATION DATE	AFBSD APP DATE	CONTRACT NO.
6202	ACCELEROMETER ASSEMBLY, GUIDED MISSILE MX-3885/DJW-15	ANGULAR ACCELEROMETER UNIT (P68)	12-62	3-11-63	AF04(694)-247

REVISIONS: REVISION DATE	REVISIONS: CODE	REVISIONS: INITIATED BY	REVISIONS: AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	STOCK NUMBER: FED SUPPLY CLASS	STOCK NUMBER: FEDERAL ITEM ID NUMBER	STOCK NUMBER: MANUFACTURER'S PART NUMBER	BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
	6A			NA	1420	819-8046-AH	25170-102	1									*** $29,000.			CFE		46 weeks	W-6	Unclassified Block No. 1, 2, 34 and 1, 7, 10

I. TECHNICAL REQUIREMENTS

A requirement exists for a device capable of measuring pitch and yaw angular rates for first and second stage flight.

A. FUNCTIONAL REQUIREMENTS

The Angular Accelerometer Unit (P68) shall be the device that will obtain missile pitch and yaw angular rates to be used in the mechanization of the first and second stage flight control equations.

***The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE ACCELEROMETER ASSEMBLY, GUIDED MISSILE MX-3885/DJW-15

FIG A NUMBER 6202

PRELIMINARY DATA. NOT TO BE USED FOR PROCUREMENT.

SHEET 1 OF 5

REV SYM B

I. TECHNICAL REQUIREMENTS

B. DESIGN CONSTRAINTS

1. Power

a. Ground Power: The P68 will be supplied by the following appropriate ground power sources:

(1) Electronic: 28 ± 2.0 VDC (G&C Umbilical)

(2) Electrical Heater: 28 ± 3.0 VDC (Skirt Umbilical)

b. Airborne Power: The electronics and the heater will obtain their electrical power from a common third stage battery source with a voltage of $28^{+2.0}_{-2.0}$ VDC.

2. Physical

a. Weight: The P68 weight shall not exceed 14.4 pounds in order that the Second Stage Flight Control weight shall not exceed 104.4 pounds.

b. Dimensions: The P68 dimensions shall be in accordance with the applicable drawings called out in ICD 25-16379.

c. Identification and Marking: The P68 shall be identified by a nameplate with the following information:

(1) Nomenclature
(2) Stock number
(3) Serial number
(4) Part number
(5) Contract number
(6) Company name
(7) U S

3. Interface:

a. Electrical: The P68 shall have the following electrical interfaces:

(1) The P68 interfaces with the P92 Control and Discrete Unit, P92 portion of Figure A, Item 6275.

(2) The P68 interfaces with the Stage III Airborne battery (Figure A, Item 6270).

(3) The P68 interfaces with the ground power sources. (Fig. A 13002)

(4) The P68 interfaces with the P94 cable assembly (Figure A, Item 6273).

b. Physical: The P68 has the following physical interfaces:

(1) The P68 interfaces with the II-III Interstage Compartment.

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

3. Interface (Cont'd)

(2) The P68 interfaces with the P94 cable assembly (Fig. A #6273).

4. Environmental:

a. Ambient

(1) Non-operative

(a) Pressure - Altitude: As specified in para. 3.3.2 (a) and 3.3.3 (a) of AF/BSD 62-51.

(b) Temperature: As specified in the applicable portions of para. 3.3.2 (b) and 3.3.3 (b) of AF/BSD Exhibit 62-51.

(c) Sunshine: As specified in para. 3.3.2 (c) of AF/BSD Exhibit 62-51.

(d) Wind: As specified in para. 3.3.2 (d) and 3.3.3 (e) of AF/BSD Exhibit 62-51.

(e) Wind: borne Matter (rain, snow, hail, ice, sand and dust) - As specified in para. 3.3.2 (e) and 3.3.3 (f) of AF/B SD Exhibit 62-51.

(f) Humidity: As specified in para. 3.3.2 (f) and 3.3.3 (c) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified in para. 3.3.3 (d) of AF/BSD Exhibit 62-51.

(2) Operative

(a) Pressure - Altitude: As specified in the applicable paragraphs of AF/BSD Exhibit 62-81 and report AFCRC - TR-59-267. Also paragraph 3.3.1 (2) of AFBSD Exhibit 62-51.

(b) Temperature: As specified in para. 3.3.4 (b) and 3.3.1 (b) of AF/BSD Exhibit 62-51, and the applicable paragraphs of AFBSD Exhibit 62-69.

(c) Sunshine: As specified in para. 3.3.1 (c) of AF/BSD Exhibit 62-51.

(d) Wind: As specified in para. 3.3.1 (d) of AF/BSD Exhibit 62-51.

(e) Wind - borne Matter: As specified in para 3.3.1 (e) of AF/BSD Exhibit 62-51.

(f) Humidity: As specified in para. 3.3.1 (f) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified in para. 3.3.1 (g) of AF/BSD Exhibit 62-51.

(h) Salt Atmosphere: As specified in para. 3.3.1 (g) of AF/BSD Exhibit 62-51.

(i) Radiation (Nuclear and Electromagnetic): As specified in the AF/BSD Exhibit 62-87.

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

b. Dynamic

(1) Non-operative

(a) Shock: As specified in para. 3.3.2 (g) in AF/BSD Exhibit 62-51.

(b) Vibration: As specified in para. 3.3.2 (h) in AF/BSD Exhibit 62-51.

(2) Operative

(a) Angular Oscillation: As specified in para. 3.3.5 (d) of AF/BSD Exhibit 62-51.

(b) Acoustic Field: As specified in para. 3.3.5 (e) of AF/BSD Exhibit 62-51.

(c) Sustained Acceleration: As specified in para. 3.3.5 (f) of AF/BSD Exhibit 62-51.

(d) Vibration: As specified in para. 3.3.5 (g) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions).

(e) Shock: As specified in para. 3.3.5 (h) and 3.3.1 (i) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions.)

c. Electro-Interference: As specified in para. 3.3.1 (j) which references AF/BSD 62-87 (paragraph 3).

5. Weapons Effects: The P68 shall be designed to withstand the environments of the applicable paragraphs of AFBSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

6. Monitoring: All missile periodic and preflight checkout of the P68 shall be done in conjunction with the P92.

7. Operating Life: The P68 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts, or similar problems of aging.

8. Safety Considerations: The P68 shall be constructed to provide, to the greatest extent possible, maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: This equipment shall comply with the electrical grounding requirements of AFBSD Exhibit 62-75.

I. TECHNICAL REQUIREMENTS (Cont'd)

C. OPERABILITY AND MAINTAINABILITY

The P68 shall conform to the applicable paragraphs of AF/BSD Exhibit 62-53 and AF/BSD Exhibit 61-99.

D. RELIABILITY

The P68 shall conform to the applicable paragraphs of AF/BSD Exhibit 62-50 and the apportionment of Appendix R to the AF04(694)-247 contract.

E. APPLICABLE DOCUMENTS

1. AF/BSD Exhibit 61-99: Human Engr. Design Criteria.
2. AF/BSD Exhibit 62-50: Reliability Design Criteria.
3. AF/BSD Exhibit 62-51: WS-133B, Environmental Design Criteria, Minuteman.
4. AF/BSD Exhibit 62-58: Design Criteria for WS-133B Guidance and Control System (Airborne and Ground).
5. AF/BSD Exhibit 62-77: Electrical Power and Cabling Subsystem Design Criteria.
6. AF/BSD Exhibit 62-82: Weapon System Safety Criteria.
7. AF/BSD Exhibit 62-83: Weapon Effects Criteria. (See Supp. I to this Fig. A for exceptions)
8. AF/BSD Exhibit 62-87: Electro Interference Control Requirements for Minuteman (WS-133B)
9. AF/BSD Exhibit 62-98: Packaging Preservation and Storage.
10. AF/BSD Exhibit 62-53: Maintainability Design Criteria.
11. AF/BSD Exhibit 62-75: Electrical Grounding.

II. RECOMMENDED SOLUTION

Autonetics has been directed by AFBSD Wire BSRGQ 2/7-11-450 dated 7 Nov. 1962 to use the Angular Accelerometer Unit NAA Part No. 25170-102NC to satisfy the technical requirements of Part I. The performance of the P68B AAU shall be as specified in P68B Model Specification S-133-1004-12. Where conflict exists between the WS-133B criteria, and this model specification, the requirements of the model specification shall take precedence.

AUTONETICS
A DIVISION OF NORTH AMERICAN AVIATION, INC.

TYPE OF LIST A	AEROSPACE VEHICLE EQUIPMENT
MODEL DESIGNATION B	SM80 WEAPON SYSTEM
SUB SYSTEM IDENTIFICATION C	
CONTRACTOR D	Autonetics, A Division of North American Aviation, Inc.
FIGURE A NUMBER E	6210
MILITARY NOMENCLATURE AND FED. MFR'S CODE 94756 F	BATTERY POWER SUPPLY PP3249/DJW-15
COMMON NOMENCLATURE G	AIRBORNE BATTERY (SE13G)
ORIGINATION DATE H	12/15/62
AFBSD APP DATE J	3-11-63
CONTRACT NO. K	AF04(694)-247

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
4/15/63	6A			N/A			66603-107										*3200.00			CFE	34 wks		W-6	REFERENCE: Block I 35 Provide Power

I. TECHNICAL REQUIREMENTS

A. FUNCTIONAL REQUIREMENTS

A means is required to supply primary electrical power during flight and for approximately 24 seconds prior to lift-off to the NS-17 Guidance Set F/C Electronics, F/C Hydraulics and Attitude Control Injector Unit for the WS-133B Missile. The means shall be inert until receiving an activation command in the form of an appropriate electrical signal. It shall be capable of being activated on command up to three years following installation of the missile into the silo.

B. DESIGN CONSTRAINTS

1. Power

a. A requirement exists to supply electrical power to the first stage flight control electronics, NS17 Guidance Set (Fig. A 6275), second and third stage electronics and hydraulic power the Attitude Control Injector (Fig. A 6262) and the following discretes:

(1) Stage I-II separation
(2) Stage II ignition
(3) Stage II skirt jettison
(4) LITVC ignition, 2nd stage
(5) Roll control initiation
(6) Stage II-III separation

* The estimate set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

I. **TECHNICAL REQUIREMENTS** (Continued)

B. **DESIGN CONSTRAINTS** (Continued)

1. **Power** (Continued)

a. (Continued)

(7) Stage III ignition
(8) Stage III skirt jettison
(9) Stage III thrust termination

b. The nominal load profile shall be as follows:

(1) 70.0 amps from -24 seconds to 71 seconds
(2) 71.4 amps from 71 seconds to 132 seconds
(3) 63.9 amps from 132 seconds to 202 seconds
(4) The discrete current pulses required for the 212 second period
(5) The system will impose a ± 4 amp ripple due to switching loads in addition to this profile.

c. A second power supply shall be capable of supplying electrical power to the first stage hydraulic pump. When activated, the battery voltage shall be +29 (+2 -4) volts DC when subjected to a nominal load current of 160 amps for 80 seconds.

2. **Physical**

a. The weight of the battery, including the wiring and hardware, shall not exceed 15 pounds.

b. Physical dimensions shall not exceed 4x6x10 inches.

c. The case of the battery shall be isolated from its terminals.

d. The battery shall be hermetically sealed.

3. **Interface**

Electrical interface shall be made to the Stage I hydraulic pump or to the Missile Cabling Set

I. TECHNICAL REQUIREMENTS (Continued)

B. DESIGN CONSTRAINTS (Continued)

4. Environmental

a. Ambient

(1) Non-Operating

(a) Humidity - The battery shall withstand relative humidity ranging up to 100 percent with conditions such that condensation takes place in the form of water or frost.
(b) Altitude - The battery shall withstand pressures representing sea level to 30,000 feet.
(c) Temperature - The battery shall withstand surrounding air temperatures ranging from a minimum of -60F during unrestricted air transport, and -35F during ground handling; to a maximum of 115F under sheltered and unsheltered ground conditions.
(d) Salt Spray - The battery shall withstand the Salt Spray Tests as specified in par. 4.2.1.9 of AF/BSD Exhibit 62-51.
(e) Fungus - The battery shall withstand the Fungus Resistance Test of par. 4.2.1.6 of AF/BSD Exhibit 62-51.
(f) Sand and Dust - The battery will withstand Sand and Dust Test as specified in par. 4.2.1.7 of AF/BSD Exhibit 62-51.

(2) Operating

(a) Humidity - The battery shall withstand a relative humidity of 95 percent.
(b) Altitude - The battery shall withstand pressures representing sea level to 200,000 feet.
(c) Temperature - The battery shall withstand surrounding air temperatures ranging from 60F to 80F.

b. Dynamic

(1) Non-Operating

(a) Vibration - The battery shall withstand vibrations of which the combined maximum effect can be represented by sinusoidal vibrations of the following amplitudes: 5-50 cps - 3.5 grms (limited to 0.4 inch double amplitude), 50-300 cps - 1.5 grms.
(b) Shock - The battery shall withstand handling shocks involved in free-drops up to one inch, and pivot drops of up to four inches on unpackaged equipment, resulting in acceleration peaks of the order of 100 g.

I. TECHNICAL REQUIREMENTS (Continued)

B. DESIGN CONSTRAINTS (Continued)

4. Environmental (Continued)

b. Dynamic (Continued)

(2) Operating

(a) Vibration - The battery shall withstand complex vibration values (including sinusoids and random noise) representing vibration of maximum severity in the worst expected flight.

(b) Sustained Acceleration - The battery, starting 24 (+2, -0) seconds after start of activation shall withstand acceleration from zero to 13 g. along its "Z" axis as rapidly as test facilities permit, but not exceeding 5 seconds. During the above acceleration, the battery shall also withstand 2 g. acceleration along its "X" and "Y" axes.

(c) Acoustical - The battery shall withstand sound pressure levels on the order of 140 db (referenced to 0.0002 dyne/cm^2), largely below 300 cps, with no more than 167 db in any 1/3 active bond up to 10,000 cps.

5. Weapons Effect - The battery shall meet the requirements as defined in AF/BSD Exhibit 62-83.

6. Monitoring - Not Applicable

7. Operating Life

a. Storage Life - The battery shall be designed for storage life of 5 years without maintenance before operational use and shall be capable of meeting all specified requirements at any time during storage life.

b. Active Life - The operational life required is the 226 second interval beginning at the start of activation.

8. Safety Considerations

a. Fire Hazard - The design and construction of the battery shall be such that its use shall not create a fire hazard under any condition of storage or operation within the load requirements until more than 400 seconds after activation.

I. TECHNICAL REQUIREMENTS (Continued)

B. DESIGN CONSTRAINTS (Continued)

9. Special Considerations

a. The battery shall not activate unless subjected to external radio interference signal levels which induce currents of more than one ampere in either or both squib bridge wires.

b. The battery shall not be degraded unless continuously subjected to external radio interference levels which induce currents of more than 50 microamperes in either or both bridge wires.

C. OPERABILITY AND MAINTAINABILITY

The battery shall satisfy the applicable maintainability criteria set forth in AF/BSD Exhibit 62-58.

D. RELIABILITY

The battery will meet the requirements of Exhibit "R" of Letter Contract AF04(694)-247.

E. APPLICABLE DOCUMENTS

1. AF/BSD Exhibit 62-51, Environmental Design Criteria, dated June 12, 1962
2. AF/BSD Exhibit 62-58, G&C Subsystem Design Criteria, dated June 11, 1962
3. AF/BSD Exhibit 62-87, Electro-Interference Control Requirements, dated June 15, 1962
4. AF/BSD Exhibit 62-83, Vulnerability Criteria
5. Specification NA 5-15809
6. AF/BSD Exhibit 62-75, Electrical Grounding Criteria for WS-133B Minuteman Weapon Systems

II. RECOMMENDED SOLUTION

It is recommended that two SE13G batteries be utilized to fulfill the above technical requirements.

A. FUNCTIONAL DESCRIPTION

One battery, designated as the Stage I battery, would be placed in the first stage and would supply the load requirements as described in paragraph I. B. 1. c. The other battery, designated as the Stage III battery, would be placed in the NS17 and would supply the load requirements as described in paragraph I. B. 1. b of Technical Requirements.

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION

1. Power

When activated, the Stage III battery voltage will be 29 (+1, -2) volts DC when subjected to a load in a manner described in paragraph I. B. 1. b of Technical Requirements.

When activated, the Stage I battery voltage will be 29 (+2, -4) volts DC when subjected to the load described in paragraph I. B. c of Technical Requirements.

2. Physical - The weight of the battery and wiring hardware will not exceed 15 lbs. The dimensions of the battery will be 4" x 6" x 10".

3. Interface - Electrical interface will be accomplished through the missile cabling set.

4. Environmental - Manufacture of the battery will be such that the environmental requirements of paragraph I. 4 are fulfilled.

5. Weapons Effect - The battery will meet the requirements as defined in AF/BSD Exhibit 62-83.

6. Monitoring - Not Applicable

7. Operating Life

a. Storage Life - The battery will be capable of being stored for five years (with hermetic seal intact).

b. Activated Life - 212 seconds, delivering the power requirements stipulated in Technical Requirements paragraph I. B. 1. b.

8. Safety Considerations - The battery will automatically dissipate itself upon accidental squib explosion. Rupture of the battery electrolyte container may cause caustic liquid flow and release of hydrogen gas.

9. Special Considerations

Supplementary requirements to those listed in the applicable documents are to be found in NA 5-15809, Basic Equipment Specification.

Activation Current - A current of 1 ampere shall not activate the battery. A current of 7(+1.0 -0) amperes for 200 milliseconds shall activate the battery in less than 4 seconds.

The battery is considered activated when it is able to fulfill the power requirements of paragraph I. B. 1. b and I. B. 1. c of the Technical Requirements.

II. RECOMMENDED SOLUTION (Continued)

C. OPERABILITY AND MAINTAINABILITY

The battery will be constructed so as to eliminate maintenance. The terminal lugs will be size coded to eliminate the possibility of improper connection.

D. RELIABILITY

The battery shall meet the requirements of Exhibit "R" of Letter Contract AF04(694)-247.

E. REFERENCE DOCUMENTS

1. Model Specification NA 5-15809

2. AID 20041-111

TYPE OF LIST: AEROSPACE VEHICLE EQUIPMENT

MODEL DESIGNATION: SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION: 85192-306

CONTRACTOR: AUTONETICS, A Division of North American Aviation, Inc.

FIGURE A NUMBER: 6250

MILITARY NOMENCLATURE AND FED MFR'S CODE:

COMMON NOMENCLATURE: ELECTROMECHANICAL DECODER (D43A)

ORIGINATION DATE:

AFBSD APP DATE: 3-11-63

CONTRACT NO.: AF04(694)-247

REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
9/23/62	6A	CDS		NA			55800-304	X									*** $3,000			CFE		50 WKS	W-6	Unclassified Form B reference Block #2.72

I. TECHNICAL REQUIREMENTS

A requirement exists for a means to provide protection against inadvertent launch or other missile ordnance catastrophe by safeguarding the missile Safe & Arm (S&A) arming function and the Stage I engine ignition function.

A. FUNCTIONAL REQUIREMENTS

This means shall be capable of performing the following functions; satisfying the Technical Requirements.

1. Provide interrupting switch contacts in series with the S&A ARM CONTROL line and in series with the *STAGE I IGNITION* line.

In order to provide this protection in the presence of any conceivable malfunction or maintenance condition in the launch facility OGE and cabling, these interrupting contacts shall be incorporated within the missile itself. Furthermore, any circuits which control the closure of these contacts shall not be accessible from the outside of the assembled missile

*** The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE ELECTROMECHANICAL DECODER (D43A)

FIG A NUMBER 6250

PRELIMINARY DATA NOT TO BE USED FOR PROCUREMENT

I. <u>TECHNICAL REQUIREMENTS</u> (Cont'd)

A. <u>FUNCTIONAL REQUIREMENTS</u> (Cont'd)

2. Closure control and monitoring of the switch contacts shall be commanded by the D37B Digital Computer Unit (DCU) (part of Figure A, Item 6275) under program control. Protection shall be provided both against digital computer malfunctions and against noise or unintentional signals impressed upon the control lines at a time when the upstage/downstage connector is exposed (e.g. during removal and replacement of the guidance section). This protection shall be provided by utilizing a switch in series with the control lines.

3. The code employed to penetrate this device shall be a sequence of 18 binary code bits issued by the DCU.

4. Means shall be provided for the digital computer to monitor the SAFE/ARM status and the NULL/OFF NULL signal of this device. Because safing pins can be inserted in the Safety Control Switch when personnel are present at the launch facility, it shall not be required that the status of this device be monitored by means other than the DCU.

B. <u>DESIGN CONSTRAINTS</u>

The exceptions and/or deviations which are taken to applicable design constraints are listed and explained in Supplement I to this Figure A.

1. <u>Power</u>: The device shall be capable of operating from a +28VDC ± 10% source via the command reset, mark command and space command lines.

2. <u>Physical</u>: The device shall not exceed 6.0 inches long by 4.5 inches wide by 4.8 inches high. The weight shall not exceed 4 pounds exclusive of mounting brackets, heat shield (if required), external cabling and connectors (cable terminal).

3. <u>Interface</u>: The end item shall provide the necessary interface to the following:

a. Digital Computer Unit D37B (Part of Figure A, Item 6275)

b. A/B Safe and Arm Motors

c. Stage I Ignition Squibs

1. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

3. d. P92 Control and Discrete Unit (Part of Figure A, Item 6275)

e. C163A Signal Data Converter Set (via SCS) (Figure A, Item 13000)

f. Safety Control Switch (Figure A, Item 1337)

g. P93 Cable Assembly (Figure A, Item 6272)

4. Environmental: The device shall be capable of withstanding operating and non-operating environmental conditions as specified.

a. Ambient: The device shall be capable of operating under the applicable environmental condition as specified in AFBSD Exhibit 62-51, and its applicable documents.

b. Dynamic: The device shall conform to environmental requirements specified in AFBSD Exhibit 62-83 as a design objective. The decoder need not operate during flight environment but shall be capable of mechanically surviving a flight environment. (A pin locking device shall be required to insure positive code locking during handling and transportation as defined in AFBSD Exhibit 62-51).

c. The device shall have as its design requirement the applicable electro-interference requirements set forth in AFBSD Exhibit 62-87.

5. Weapons Effects: This device shall conform to AFBSD Exhibit 62-83, as a design objective.

6. Monitoring: The device shall be monitored by two output lines: (1) the "SAFE/ARMED" signal will indicate the armed position of the device, (2) the "NULL/OFF NULL" signal will indicate the reset position of the code wheel. Monitor voltage excitation shall be supplied by the digital computer unit.

7. Operating Life: The operating life of this device shall be as defined in AFBSD Exhibit 62-58.

8. Safety Considerations: The safety considerations for this device shall conform to the applicable portions as defined in AFBSD Exhibit 62-82.

9. Special Considerations: Not Applicable.

C. OPERABILITY AND MAINTAINABILITY

The device shall satisfy the applicable maintainability criteria set forth in AFBSD Exhibit 62-53.

BSD WIRE
BSRGQ 2/9-11-452
Dated 14 Nov. 1962

FIGURE A NUMBER 6250
SHEET 3 OF 7

I. TECHNICAL REQUIREMENTS (Cont'd)

D. RELIABILITY

The end item shall conform to AFBSD Exhibit 62-50 and AFBSD Exhibit "R" to Letter Contract AF04(694)-247 with exceptions, if any, noted in I. E. below.

E. APPLICABLE DOCUMENTS

Deviations are taken to paragraphs noted. Deviations and reasons constitute a supplement to this Figure A.

1. AFBSD Exhibit 62-50, dated 12 June 1962, titled Reliability Design Criteria.
2. AFBSD Exhibit 62-51, dated 12 June 1962, titled Environmental Design Criteria Minuteman.
3. AFBSD Exhibit 62-53, dated 20 June 1962, titled Maintainability.
4. AFBSD Exhibit 62-58, dated 1 February 1963, titled Design Criteria for WS-133B G&C Subsystem, Paragraph 4.2.1.1.
5. AFBSD Exhibit 62-75, dated 7 June 1962, titled Electrical Grounding Criteria for WS-133B Minuteman.
6. AFBSD Exhibit 62-82, dated 15 May 1962, titled WS-133B Weapon System Safety Criteria.
7. AFBSD Exhibit 62-83, (no date) titled WS-133B Vulnerability.
8. AFBSD Exhibit 62-87, dated 15 June 1962, titled Electro-Interference Control Requirements for Minuteman (WS-133B), Paragraphs 1.1, 3.1.1
9. AFBSD Exhibit "R" to Letter Contract AF04(694)-247.

II. RECOMMENDED SOLUTION

It is recommended that an Electromechanical Decoder (EMD), Autonetics Model D43A, be designed and fabricated to fulfill the Technical Requirements.

A. FUNCTIONAL DESCRIPTION

The D43A Electromechanical Decoder will be capable of decoding a digital message received from the DCU. Upon decoding the proper message, switch contacts will be actuated which will allow S&A motor current and first stage ignition squib current to pass while providing an indication of arming. The device will be designed to prevent an accidental launch or other missile ordnance catastrophe due to any equipment malfunction. The above functional description will be accomplished by incorporating the following features in this device:

II. RECOMMENDED SOLUTION

A. FUNCTIONAL DESCRIPTION (Cont'd)

1. The decoder will be capable of accepting an 18 bit digital message. The EMD shall step sequentially with each proper input bit resulting in a discrete mechanical movement of the sequencing device. On receipt of the 18th correct bit an output switch consisting of three sets of electrically isolated contacts will be activated allowing S&A motor current and first stage ignition squib current to pass while providing a positive indication of arming. The decoder will be required only to pass the required currents, not to switch them.

2. In the event that an incorrect bit is inserted, the decoder sequencing device will automatically return to the null condition and will be incapable of receiving either correct or incorrect bits pending receipt of a command reset.

3. The 18 bit code contained in the D43A will be inserted manually, and can only be changed manually by qualified personnel at the SRA depot.

4. The D43A will be capable of transmitting SAFE/ARM status and the NULL/OFF NULL signal to the D37B, Digital Computer Unit. (Part of Figure A, Item 6275)

B. DESIGN DESCRIPTION

1. Power: The D43A will be capable of operating properly from a +28 VDC ± 10% source via command lines (mark, space and reset lines).

2. Physical: The size of the D43A shall not exceed 6.0 inches long by 4.5 inches wide by 4.0 inches high. The weight shall not exceed 4 pounds exclusive of mounting brackets, heat shield (if required), external cabling and connectors (cable termination).

3. Interface: The D43A will interface to the following equipment:

a. Digital Computer D37B, (Part of Figure A, Item 6275). (AID 10011-111)

b. A/B Safe & Arm Motors (ICD 25-15417)

c. Stage I Ignition Squibs (ICD 25-15417)

d. P92 Control and Discrete Unit (Part of Figure A, Item 6275) (AID 10011-111)

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

3. e. C163A Signal Data Converter Set (via SCS) (Figure A, Item 13000). (AID 10011-111)

f. P93A Cable Assembly (Figure A, Item 6272) (ICD 25-15417)

4. Environmental: The D43A will possess sufficient structural integrity to avoid breaking up in flight.

a. Ambient

(1) Operating Conditions

Temperature: +40°F to 115°F

Altitude: 7000 feet maximum

Humidity: 0 to 90% relative (R.H.)

Fungus Growth: Fungus growth occurring on nutrient organic materials, including contamination from grease, oils, dust, etc., for all conditions exceeding 60% R.H. and 60°F.

(2) Non-Operating

Temperature: -65°F to +150°F for periods up to 50 hours

Altitude: 50,000 feet maximum during air transport

Humidity: 0 to 100% relative (R.H.)

b. Dynamic: The D43A will conform to applicable environmental requirements as defined in AFBSD Exhibit 62-83 as a design objective. A pin locking device will be required to insure positive code locking under shock and vibration as defined in AFBSD Exhibit 62-51.

c. The D43A in its operating configuration will have as its design requirement the electro-interference requirements specified in AFBSD Exhibit 62-87.

5. Weapons Effects: The equipment shall conform to the applicable paragraphs as set forth in AFBSD Exhibit 62-83, as a design objective.

6. Monitoring: The device shall be monitored by two output lines: (1) the "SAFE/ARMED" signal will indicate the armed position of the EMD, (2) the "NULL/OFF NULL" signal will indicate the reset position of the code wheel. Monitor voltage excitation will be supplied by the digital computer unit.

BSD WIRE
BSRGQ 2/9-11-452
Dated 14 Nov. 1962

II. RECOMMENDED SOLUTION

B. DESIGN DESCRIPTION (Cont'd)

7. Operating Life: The operating life of the D43A will be as defined in AFBSD Exhibit 62-58.

8. Safety Considerations: The safety considerations for the D43A will be as defined in AFBSD Exhibit 62-82.

9. Special Considerations: Not applicable.

C. OPERABILITY AND MAINTAINABILITY

Removal and replacement of the D43A will be accomplished during missile disassembly at MAMS. The failed D43A will then be sent to the specialized repair area (SRA) for repair or replacement.

D. RELIABILITY

The D43A Electromechanical Decoder shall conform to the applicable Reliability Requirements as defined in AFBSD Exhibit 62-50, and AFBSD Exhibit "R" of Letter Contract AF04(694)-247.

E. REFERENCE DOCUMENTS

Contractors applicable documents to be listed when available.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
AEROSPACE VEHICLE EQUIPMENT	SM-80 WEAPON SYSTEM	85000-306	AUTONETICS, A Division of North American Aviation, Inc.

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE	AFBSD APP DATE	CONTRACT NO.
6261	(94756)	FIRST STAGE NOZZLE CONTROL (P89)	12/7/62	3-11-63	AF04(694)-247

REVISIONS: REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	STOCK NUMBER: FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
	6A			NA				1									*** $46,000			CFE			W-6	Unclassified

I. TECHNICAL REQUIREMENTS

A requirement exists for the capability of changing the position of four moveable nozzles to obtain Thrust Vector Control for the purpose of controlling missile attitude in pitch, yaw, and roll.

A requirement exists for the use of specific types of major components as specified in paragraph 4.2.4.1.1.1 of AF/BSD Exhibit 62-58. See Supplement I to this figure A for exceptions.

A. FUNCTIONAL REQUIREMENTS

1. The end item shall have the capability of moving the nozzles through an angular rotation of ±8.0 degrees.
2. The end item shall have the capability of moving the nozzles at a minimum rate of 20°/sec when the nozzles are loaded as specified in Appendix B of 62-58.
3. The end item shall provide a voltage proportional to nozzle position.
4. The crosstalk between channels shall be kept to a minimum.

***The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

WS-133B Form B

Reference

1, 2, 32

NOMENCLATURE FIRST STAGE NOZZLE CONTROL (P89)

FIG A NUMBER 6261

PRELIMINARY DATA NOT TO BE USED FOR PROCUREMENT

SHEET 1 OF 9

I. TECHNICAL REQUIREMENTS

B. DESIGN CONSTRAINTS

1. Power:

a. Ground Power: The end item shall be supplied by the following ground power sources. The voltages shall be measured at the appropriate umbilical.

(1) Electronic: $28 {+2.0 \atop -2.0}$ VDC (G&C Umbilical)

(2) Hydraulic: $28 {+5.0 \atop -2.0}$ VDC (Skirt Umbilical)

b. Airborne Power: The P89 will be supplied by the following airborne power sources.

(1) Electronic: $28.0 {+2.0 \atop -2.0}$ VDC G and C battery.

(2) Hydraulic: $28.0 {+2.0 \atop -2.0}$ VDC First Stage battery.

2. Physical:

a. Weight: The end item weight shall not exceed approximately 143 pounds such that the First Stage Flight Control weight shall not exceed 210 pounds.

b. The end item dimensions shall be such as not to exceed the envelope specified in ICD No. 25-38816 Stage I Nozzle Control Unit - Envelope.

c. Identification and Markings: The end item shall be identified by a nameplate with the following information.

(1) Nomenclature

(2) Stock number

(3) Serial number

(4) Part number

(5) Contract number

(6) Company name

(7) US

d. The end item shall conform to ICD dwg

I. TECHNICAL REQUIREMENTS

B. DESIGN CONSTRAINTS (Cont'd)

3. Interface: The end item has the following electrical and physical interfaces.

a. Electrical:

(1) P92 (P/O Figure A 6275)

(2) P93 Cable Assembly (Figure A No. 6272)

(3) First Stage Airborne Battery (Figure A No. 6210)

(4) G&C Airborne Battery (Figure A No. 6210)

(5) Ground Power (Figure A No. 13002)

b. Physical:

(1) P93 Cable Assembly (Figure A No. 6272)

(2) First Stage Airborne Battery (Figure A No. 6210)

(3) First Stage Engine

(4) Base Heat Deflector

4. Environmental: The P89 shall be designed to withstand the following environments.

a. Ambient:

(1) Non-operative

(a) Pressure - Altitude: As specified in paragraph 3.3.2 (a) and 3.3.3 (a) of AF/BSD Exhibit 62-51.

(b) Temperature: As specified in the applicable portions of paragraph 3.3.2 (b) and 3.3.3 (b) of AF/BSD Exhibit 62-51.

(c) Sunshine: As specified in paragraph 3.3.2 (c) of AF/BSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.2 (d) and 3.3.3 (e) of AF/BSD Exhibit 62-51.

(e) Wind - Borne Matter (Rain, snow, hail, ice, sand and dust): As specified in paragraph 3.3.2 (e) and 3.3.3 (f) of AF/BSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.2 (f) and 3.3.3 (c) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.3 (d) of AF/BSD Exhibit 62-51.

I. TECHNICAL REQUIREMENTS

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

a. Ambient (Cont'd)

(2) Operative

(a) Pressure - Altitude: As specified in the applicable paragraphs of AF/BSD 62-83 and report AFCRC - TR-59-267. Also paragraph 3.3.1 (a) of AF/BSD Exhibit 62-51. (See Supp. I to this Fig. A for exceptions).

(b) Temperature: As specified in paragraph 3.3.4 (b) and 3.3.1 (b) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-69.

(c) Sunshine: As specified in paragraph 3.3.1 (c) of AF/BSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.1 (d) of AF/BSD Exhibit 62-51.

(e) Wind - Borne Matter: As specified in paragraph 3.3.1 (e) of AF/BSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.1 (f) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.1 (g) of AF/BSD Exhibit 62-51.

(h) Salt Atmosphere: As specified in paragraph 3.3.1 (g) of AF/BSD Exhibit 62-51.

(i) Radiation (Nuclear and Electromagnetic): As specified in the applicable paragraphs of AF/BSD 62-83 also paragraph 3.3.5 (c) of AF/BSD Exhibit 62-51.

b. Dynamic

(1) Non-Operative

(a) Shock: As specified in paragraph 3.3.2 (g) of AF/BSD Exhibit 62-51.

(b) Vibration: As specified in paragraph 3.3.2 (h) of AF/BSD Exhibit 62-51.

(2) Operative

(a) Angular Oscillation: As specified in paragraph 3.3.5 (d) of AF/BSD Exhibit 62-51.

(b) Acoustic Field: As specified in paragraph 3.3.5 (e) of AF/BSD Exhibit 62-51.

(c) Sustained Acceleration: As specified in paragraph 3.3.5 (f) of AF/BSD Exhibit 62-51.

I. TECHNICAL REQUIREMENTS

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

b. Dynamic (Cont'd)

(2) Operative (Cont'd)

(d) Vibration: As specified in paragraph 3.3.5 (g) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD 62-83. (See Supp. I to this Fig. A for exceptions)

(e) Shock: As specified in paragraph 3.3.5 (h) and 3.3.1 (i) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

c. Electro - Interference: This equipment shall conform to the electro-interference requirements of AF/BSD Exhibit 62-87.

5. Weapons Effects: The P89A shall be designed to withstand the applicable weapons effects environments called out in AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions).

6. Monitoring: All missile periodic and pre-flight checkout of the P89 will be done in conjunction with the P92.

7. Operating Life: The P89A shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety Considerations: Safety considerations shall conform to the requirements of WS-133B Weapon System Safety Criteria, Minuteman AF/BSD Exhibit 62-62. (Referenced from AF/BSD Exhibit 62-58 paragraph 5.4.5)

9. Special Considerations: The nozzle control unit shall conform to the electrical grounding requirements of AF/BSD Exhibit 62-75.

C. OPERABILITY AND MAINTAINABILITY: The P89A shall conform to the applicable paragraphs of AF/BSD Exhibit 62-53 and AF/BSD Exhibit 61-99.

D. RELIABILITY: The P89 reliability shall be in accordance with its apportionment of Exhibit R to the AF04(694)-247 Contract, and shall conform to the applicable paragraphs of AF/BSD Exhibit 62-50.

E. APPLICABLE DOCUMENTS

1. AF/BSD Exhibit 62-50: Reliability Design Criteria.

2. AF/BSD Exhibit 62-51: WS-133B, Environmental Design Criteria, Minuteman.

3. AF/BSD Exhibit 62-58: Design Criteria for WS-133B Guidance and Control System (Airborne and Ground). See Supplement I of this figure A for the exceptions taken to this document.

I. TECHNICAL REQUIREMENTS

F. APPLICABLE DOCUMENT (Cont'd)

4. AF/BSD Exhibit 62-77: Electrical Power and Cabling Subsystem Design Criteria.

5. AF/BSD Exhibit 62-82: Weapon System Safety Criteria.

6. AF/BSD Exhibit 62-83: Weapon Effects Criteria. (See Supp. I to this Fig. A for exceptions).

7. AF/BSD Exhibit 62-87: Electro Interference Control Requirements for Minuteman (WS-133B).

8. AF/BSD Exhibit 62-89: Packaging Preservation and Storage.

9. AF/BSD Exhibit 62-53: Maintainability Design Criteria.

10. AF/BSD Exhibit 62-75: Electrical Grounding.

II. RECOMMENDED SOLUTION

It is recommended that the equipment designated as the First Stage Nozzle Control Unit P89 be designed and fabricated to fulfill the above technical requirement. The First Stage Nozzle Control Unit and its major components will have the following performance characteristics and physical description:

A. FUNCTIONAL DESCRIPTION

General - The P89 First Stage Nozzle Control Unit operating in conjunction with the P92 shall provide a closed loop position servo for positioning the first stage nozzles. The P89 shall consist of the following major components, 1 Hydraulic Auxiliary Power Supply, 4 Servo Cylinders.

1. Design and Construction: The design and construction of the Nozzle Control Unit shall be in accordance with Drawing and Part No. 25340-102.

2. Performance: The Nozzle Control Unit and its major components performance shall meet the following requirements:

a. Actuator Limits: The Nozzle Control Actuator Linear motion shall be mechanically limited to a total range of +3.007 (+0.000-0.015) inches.

b. Actuator Characteristics: Each Nozzle Control Actuator shall provide the following force velocity characteristics:

(1) 0-lb load: 3.75 in./sec. minimum velocity

(2) 1520-lb load: 3.75 in./sec. minimum velocity

(3) 0-in./sec. velocity: 2400-lb minimum load

c. Hydraulic Pressure: The hydraulic pressure shall be 3000 (+430, -270) psi.

II. RECOMMENDED SOLUTION

A. FUNCTIONAL DESCRIPTION (Cont'd)

2. Performance (Cont'd)

d. Feedback Output Voltage Scale Factor: The output voltage scale factor shall be approximately 13.33 volts/in. with a nominal 250 ohm output impedance.

e. Input-Feedback Output Gain: The minimum gain shall be approximately 6.25 volts/sec/milliampere for input currents less than 8.0 milliamperes.

f. Crosstalk: The crosstalk shall be such as not to interfere with the proper operation of the other channels.

g. Insulation Resistance: The insulation resistance for power and signal leads shall be as specified in paragraph 2.1.5 of AF/BSD Exhibit 62-75.

B. DESIGN DESCRIPTION

1. Power

a. Ground Power: The P89 shall be supplied by the following ground power sources.

(1) Electronic: 28 ± 2.0 VDC (G&C Umbilical)

(2) Hydraulic: $28 {}^{+5.0}_{-2.0}$ VDC (Skirt Umbilical)

b. Airborne Power: The P89 shall be supplied by the following airborne power sources.

(1) Electronic: $28 {}^{+2.0}_{-2.0}$ VDC G and C battery

(2) Hydraulic: $28 {}^{+2.0}_{-2.0}$ VDC First Stage battery

2. Physical

a. Weight: The weight of the First Stage Nozzle Control Unit P89 shall not exceed 143 pounds.

b. Dimensions: The P89 dimensions shall be in accordance with Drawing , but shall not exceed those specified in the Technical Requirements section.

C. Identification and Markings: The P89 shall be identified by a nameplate with the following information:

(1) Nomenclature

II. RECOMMENDED SOLUTION

A. FUNCTIONAL DESCRIPTION (Cont'd)

2. Performance (Cont'd)

d. Feedback Output Voltage Scale Factor: The output voltage scale factor shall be approximately 13.33 volts/in. with a nominal 250 ohm output impedance.

e. Input-Feedback Output Gain: The minimum gain shall be approximately 6.25 volts/sec/milliampere for input currents less than 8.0 milliamperes.

f. Crosstalk: The crosstalk shall be such as not to interfere with the proper operation of the other channels.

g. Insulation Resistance: The insulation resistance for power and signal leads shall be as specified in paragraph 2.1.5 of AF/BSD Exhibit 62-75.

B. DESIGN DESCRIPTION

1. Power

a. Ground Power: The P89 shall be supplied by the following ground power sources.

(1) Electronic: 28 ± 2.0 VDC (G&C Umbilical)

(2) Hydraulic: $28 {}^{+5.0}_{-2.0}$ VDC (Skirt Umbilical)

b. Airborne Power: The P89 shall be supplied by the following airborne power sources.

(1) Electronic : $28 {}^{+2.0}_{-2.0}$ VDC G and C battery

(2) Hydraulic: $28 {}^{+2.0}_{-2.0}$ VDC First Stage battery

2. Physical

a. Weight: The weight of the First Stage Nozzle Control Unit P89 shall not exceed 143 pounds.

b. Dimensions: The P89 dimensions shall be in accordance with Drawing , but shall not exceed those specified in the Technical Requirements section.

C. Identification and Markings: The P89 shall be identified by a nameplate with the following information:

(1) Nomenclature

II. <u>RECOMMENDED SOLUTION</u>

B. <u>DESIGN DESCRIPTION</u> (Cont'd)

2. <u>Physical</u> (Cont'd)

c. <u>Identification and Markings</u> (Cont'd)

(2) Stock number

(3) Serial number

(4) Part number

(5) Contract number

(6) Company name

(7) U.S.

3. <u>Interface</u>: The P89 shall have the following Electrical and Physical Interfaces.

a. <u>Electrical</u>

(1) The P89 shall interface with the P92 in accordance with Drawing No.

(2) The P89 shall interface with the P93 in accordance with Drawing No.

(3) The P89 shall interface with the First Stage Airborne Battery in accordance with AID No. 20041.

(4) The P89 shall interface with the G&C Airborne Battery in accordance with AID No. 20040.

(5) The P89 shall interface with the Ground Power in accordance with ICD No.

b. <u>Physical</u>

(1) The P89 shall interface with the P93 in accordance with Drawing No.

(2) The P89 shall interface with the First Stage Airborne Battery in accordance with AID No. 20061.

(3) The P89 shall interface with the First Stage in accordance with ICD No. 25-38051.

(4) The P89 shall interface with the first stage base heat deflector in accordance with ICD No.__________.

4. <u>Environmental</u>: The P89 design shall implement proven physical and electrical design techniques in accordance with Drawing No. to meet the following environmental requirements.

a. The P89 shall be capable of operating satisfactorily (checkout or in-flight) during exposure to a natural combination of the operative and after exposure to a natural combination of the non-operative environments specified in the technical requirements.

II. RECOMMENDED SOLUTION

B. DESIGN DESCRIPTION (Cont'd)

4. Environmental (Cont'd)

b. The electro-interference characteristics of the P89 shall be in accordance with the applicable paragraphs of AF/BSD Exhibit 62-87.

5. Weapons Effects: The P89 shall be designed to withstand the applicable weapons effects environments called out in AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions).

6. Monitoring: All Missile periodic and pre-flight checkout of the P89 shall be done in conjunction with the P92.

7. Operating Life: The P89 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety Considerations: The P89 shall be constructed to provide the greatest possible maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: None

C. OPERABILITY AND MAINTAINABILITY

The P89 shall be constructed to minimize the skill, experience, and time necessary for its assembly, operation, maintenance and repair. The P89 shall be constructed so that all assemblies, connectors, and interconnections are accessible for checking, adjustment, maintainance, and repair, with a minimum of disturbance to other parts and with a minimum quantity and variety of special tools.

D. RELIABILITY

Minuteman standard parts and proven design practices shall be utilized to their fullest extent to insure that the requirements of paragraph D of the Technical Requirements section are met.

E. APPLICABLE DOCUMENTS

Contractors applicable documents to be listed when available.

TYPE OF LIST: AEROSPACE VEHICLE EQUIPMENT	MODEL DESIGNATION: SM-80 WEAPONS SYSTEM	SUB SYSTEM IDENTIFICATION: 85001-306	CONTRACTOR: AUTONETICS, A Division of North American Aviation
FIGURE A NUMBER: 6262	MILITARY NOMENCLATURE AND FED MFR'S CODE (94756)	COMMON NOMENCLATURE: SECOND STAGE THRUST VECTOR CONTROL UNIT (P90)	ORIGINATION DATE: 12/7/62; AFBSD APPROVAL: 3-11-63; CONTRACT NO. AF04(694)-247

REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB (OR) & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
	6A			NA				1									*** $83,000			CFE		12 mo	W-6	Unclassified

STOCK NUMBER (columns FED SUPPLY CLASS, FEDERAL ITEM ID NUMBER, MANUFACTURER'S PART NUMBER); BASIS OF ISSUE AND QUOTA ALLOCATIONS (columns LF through MAMS)

I. TECHNICAL REQUIREMENTS

A requirement exists for the capability of changing the position of four pintle valves to control injection fluid flow in order to obtain thrust vector control for the purpose of controlling missile attitude in pitch and yaw.

A requirement exists for the use of specific types of major components as specified in 4.2.4.1.1.2 of AFBSD Exhibit 62-58. See Supplement I to this Figure A for exceptions.

A requirement exists for the capability of providing power amplification to the roll control command signals.

A. FUNCTIONAL REQUIREMENTS

1. The P90 shall have the capability of positioning the pintle valve to allow full fluid flow.
2. The P90 shall have the capability of moving the pintle valve at a minimum rate of 1.5 in/sec.
3. The P90 shall provide a voltage proportional to pintle position.
4. The crosstalk between channels shall be kept to a minimum.
5. The P90 shall have the capability of maintaining the pintle in the closed position when the P92 is not switched into the second stage mode.

***The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

WS-133B Form B Reference Blocks Number 1, 7, 38

NOMENCLATURE SECOND STAGE THRUST VECTOR CONTROL UNIT (P90)   FIG A NUMBER 6262

PRELIMINARY DATA NOT TO BE USED FOR PROCUREMENT   SHEET 1 OF 10

I. TECHNICAL REQUIREMENTS

A. FUNCTIONAL REQUIREMENTS (Cont'd)

6. The P90 shall have the capability of amplifying the roll command signals.

7. The P90 shall have the capability of providing a signal proportional to the amount of injectant fluid which has passed through the pintles.

B. DESIGN CONSTRAINTS

1. Power

a. Ground Power: The (P90) shall be supplied by the following ground power sources. The voltages shall be measured at the appropriate umbilical.

(1) Electronic: $28 {}^{+2.0}_{-2.0}$ VDC (G&C Umbilical)

(2) Hydraulic: $28 {}^{+5.0}_{-1.0}$ VDC (Skirt Umbilical)

b. Airborne Power: The P90 electronics and the hydraulic will obtain their electrical power from the G&C battery source with a voltage of $28 {}^{+2.0}_{-2.0}$ VDC

2. Physical

a. Weight: The P90 weight shall not exceed approximately (65) pounds such that the (Second Stage) Flight Control weight shall not exceed (104.4*) pounds (includes P68).

b. Dimensions: The P90 dimensions shall be such as not to exceed the envelope specified in I. C. D. No. 25-38017 Stage II, T. V. C. envelope.

c. Identification and Markings: The P90 shall be identified by a nameplate with the following information.

(1) Nomenclature

(2) Stock Number

(3) Serial Number

(4) Part Number

(5) Contract Number

(6) Company Name

(7) U.S.

I. TECHNICAL REQUIREMENTS

B. DESIGN CONSTRAINTS (Cont'd)

3. Interface: The P90 has the following electrical and physical interfaces.

a. Electrical

(1) P92 Control Discrete Unit (P/O Fig. A. 6275)

(2) P94 Cable Assembly (Fig. A. No. 6273)

(3) G&C Airborne Battery (Fig. A. No. 62[illegible])

(4) Ground Power Second Stage (Fig. A 13002)

b. Physical

(1) P94 Cable Assembly (Fig. A. No. 6273)

(2) Second Stage Motor

4. Environmental: The P90 shall be designed to withstand the following environments.

a. Ambient

(1) Non-operative

(a) Pressure - Altitude: As specified in paragraph 3.3.2 (a) and 3.3.3 (a) of AFBSD Exhibit 62-51.

(b) Temperature: As specified in the applicable portions of paragraph 3.3.2 (b) and 3.3.3 (b) of AFBSD Exhibit 62-51

(c) Sunshine: As specified in paragraph 3.3.2 (c) of AFBSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.2 (d) and 3.3.3 (e) of AFBSD Exhibit 62-51.

(e) Wind-Borne Matter: (Rain, snow, hail, ice, sand and dust) - As specified in paragraph 3.3.2 (e) and 3.3.3 (f) of AFBSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.2 (f) and 3.3.3 (c) of AFBSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.3 (d) of AFBSD Exhibit 62-51.

I. <u>TECHNICAL REQUIREMENTS</u>

B. <u>DESIGN CONSTRAINTS</u> (Cont'd)

(2) <u>Operative</u>

(a) Pressure - Altitude: As specified in the applicable paragraphs of AFBSD Exhibit 62-83 and report AFCRC - TR-59-267. Also paragraph 3.3.1 (a) of AFBSD Exhibit 62-51. (See Supp. I to this Fig. A for exceptions).

(b) Temperature: As specified in paragraph 3.3.4 (b) and 3.3.1 (b) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-69.

(c) Sunshine: As specified in paragraph 3.3.1 (c) of AFBSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.1 (d) of AFBSD Exhibit 62-51.

(e) Wind-Borne Matter: As specified in paragraph 3.3.1 (e) of AFBSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.1 (f) of AFBSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.1 (g) of AFBSD Exhibit 62-51.

(h) Salt Atmosphere: As specified in paragraph 3.3.1 (g) of AFBSD Exhibit 62-51.

(i) Radiation - (Nuclear and Electromagnetic): As specified in the applicable paragraphs of AFBSD Exhibit 62-87. Also paragraph 3.3.5 (c) of AFBSD Exhibit 62-51.

b. <u>Dynamic</u>

(1) <u>Non-operative</u>

(a) Shock: As specified in paragraph 3.3.2 (g) in AFBSD Exhibit 62-51.

(b) Vibration: As specified in paragraph 3.3.2 (h) in AFBSD Exhibit 62-51.

(2) <u>Operative</u>

(a) Angular Oscillation: As specified in paragraph 3.3.5 (d) of AFBSD Exhibit 62-51.

(b) Acoustic Field: As specified in paragraph 3.3.5 (e) of AFBSD Exhibit 62-51.

(c) Sustained Acceleration: As specified in paragraph 3.3.5(f) of AFBSD Exhibit 62-51.

(d) Vibration: As specified in paragraph 3.3.5 (g) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

(e) Shock: As specified in paragraph 3.3.5 (h) and 3.3.1 (i) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

c. <u>Electro-Interference</u>: This equipment shall conform to the electro-interference requirements of AFBSD Exhibit 62-87.

I. **TECHNICAL REQUIREMENTS**

B. **DESIGN CONSTRAINTS (Cont'd)**

5. Weapons Effect: The P90 shall be designed to withstand the applicable weapons effects environments called out in AFBSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

6. Monitoring: All missile periodic and preflight checkout of the P90 will be done in conjunction with the P92.

7. Operating Life: The P90 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts, or similar problems of aging.

8. Safety Considerations: Safety considerations shall conform to the requirements of WS-133B Weapons System Safety Criteria, Minuteman BSD Exhibit 62-62. (Reference from BSD Exhibit 62-58 paragraph 5.4.4).

9. Special Considerations: This equipment shall conform to the electrical grounding requirements of AFBSD Exhibit 62-75.

C. **OPERABILITY AND MAINTAINABILITY**

The P90 shall conform to the applicable paragraphs of AFBSD Exhibit 62-53 and AFBSD Exhibit 61-99.

D. **RELIABILITY**

The P90 reliability shall be in accordance with its apportionment of Appendix R to the AF-04-(694-247) Contract, and shall conform to the applicable paragraphs of AFBSD Exhibit 62-58.

E. **APPLICABLE DOCUMENTS**

1. AFBSD Exhibit 61-99: Human Engineering Design Criteria
2. AFBSD Exhibit 62-50: Reliability Design Criteria
3. AFBSD Exhibit 62-51: WS-133B, Environmental Design Criteria, Minuteman
4. AFBSD Exhibit 62-58: Design Criteria for WS-133B Guidance and Control System (Airborne and Ground).
5. AFBSD Exhibit 62-77: Electrical Power and Cabling Subsystem Design Criteria
6. AFBSD Exhibit 62-82: Weapon System Safety Criteria
7. AFBSD Exhibit 62-83: Weapon Effects Criteria (See Supp. I to this Fig. A for exceptions)
8. AFBSD Exhibit 62-87: Electro Interference Control Requirements for Minuteman (WS-133B).

I. TECHNICAL REQUIREMENTS

E. APPLICABLE DOCUMENTS (Cont'd)

9. AFBSD Exhibit 62-89: Packaging Preservation and Storage.

10. AFBSD Exhibit 62-53: Maintainability Design Criteria

11. AFBSD Exhibit 62-75: Electrical Grounding

II. RECOMMENDED SOLUTIONS

It is recommended that the equipment designated as the Second Stage Thrust Vector Control Unit (P90) be designed and fabricated to fulfill the above Technical Requirements. The Second Stage Thrust Vector Control Unit and its major components will have the following performance characteristics and physical description.

A. FUNCTIONAL DESCRIPTION

General: The P90 Second Stage Thrust Vector Control Unit operating in conjunction with the P92 shall provide a closed loop position servo for positioning the second stage pintle valves. The P90 shall amplify the roll command signals from the computer. The P90 shall consist of the following major components: 2 Hydraulic Auxiliary Power Supplied; 4 Servo Injectors; and 1 Roll Amplifier Assembly.

1. Design and Construction: The design and construction of the P90 Thrust Vector Control Unit shall be in accordance with Drawing and Part No.________.

2. Performance: The Thrust Vector Control Unit and its major components shall meet the following requirements:

a. Actuator Limits: The pintle valve control actuator linear motion shall be mechanically limited to a total range of approximately (0.272 in.).

b. Actuator Characteristics: Each pintle valve control actuator shall be capable of moving at a minimum velocity of 1.5 in./sec.

c. Hydraulic Pressure: The hydraulic pressure shall be approximately $406 \begin{smallmatrix} +50.0 \\ -0.0 \end{smallmatrix}$ psi.

d. Feedback Output Voltage Scale Factor: The output voltage scale factor shall be approximately 44.2 volts/in. with a nominal 250 ohm output impedence.

e. Input-Feedback Output Gain: The minimum gain shall be approximately 8.25 volts/sec/milliampere for input currents less than 8.0 milliamperes.

f. Crosstalk: The crosstalk shall be such as not to interfere with the proper operation of the other channels.

g. The P90 shall maintain a closed pintle when the P92 is not in the second stage mode.

II. <u>RECOMMENDED SOLUTIONS</u>

A. <u>FUNCTIONAL DESCRIPTION</u> (Cont'd)

h. The P90 shall provide sufficient current to the roll valve solenoids.

i. The P90 shall provide a signal proportional to the output of the injector fluid which has passed through the pintles.

B. <u>DESIGN DESCRIPTION</u>

1. <u>Power</u>

a. <u>Ground Power</u>: The P90 shall be supplied by the following ground power sources.

(1) Electronic: 28 ± 2.0 VDC. (G&C Umbilical)

(2) Hydraulic: $28 \, {}^{+5.0}_{-1.0}$ VDC. (Skirt Umbilical)

b. <u>Airborne Power</u>: The P90 shall be supplied by the following airborne power sources.

(1) Electronic: $28 \, {}^{+2.0}_{-2.0}$ VDC G&C Battery

(2) Hydraulic: $28 \, {}^{+2.0}_{-2.0}$ VDC First Stage Battery

2. <u>Physical</u>

a. <u>Weight</u>: The weight of the second stage thrust vector control (P90) shall not exceed 65 pounds.

b. The P90 dimensions shall be in accordance with Drawing No. ( ) but shall not exceed those specified in the Technical Requirements section.

c. <u>Identification and Markings</u>: The (P90) shall be identified by a nameplate with the following information.

(1) Nomenclature

(2) Stock Number

(3) Serial Number

(4) Part Number

(5) Contract Number

(6) Company Name

(7) U. S.

II. RECOMMENDED SOLUTIONS

B. DESIGN DESCRIPTION (Cont'd)

3. Interface: The P90 shall have the following electrical and physical interfaces.

a. Electrical

(1) The P90 shall interface with the P92 in accordance with Drawing No.________.

(2) The P90 shall interface with the P94 in accordance with Drawing No.________.

(3) The P90 shall interface with the G&C Airborne Battery in accordance with AID NO.______.

(4) The P90 shall interface with the Ground Power Second Stage in accordance with ICN No.________.

b. Physical

(1) The P90 shall interface with the P94 in accordance with Drawing No.________.

(2) The P90 shall interface with the Second Stage Motor in accordance with I.C.D. No.________.

4. Environmental: The P90 design shall implement proven physical and electrical design techniques in accordance with Drawing No.________, to meet the following environmental requirements:

a. The P90 shall be capable of operating satisfactorily (checkout or in-flight) during exposure to a natural combination of the operative and after exposure to a natural combination of the non operative environments specified in the Technical Requirements.

b. The electro-interference characteristics of the P90 shall be in accordance with the applicable paragraphs of AFBSD Exhibit 62-87.

5. Weapons Effects: The P90 shall be designed to withstand the applicable weapons effects environments called out in AFBSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

6. Monitoring: All missile periodic and pre-flight checkout of the P90 shall be done in conjunction with the P92.

7. Operating Life: The P90 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts, or similar problems of aging.

8. Safety Considerations: The P90 shall be constructed to provide the greatest possible maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: None

II. RECOMMENDED SOLUTIONS

C. OPERABILITY AND MAINTAINABILITY

The (P90) shall be constructed to minimize the skill, experience, and time necessary for its assembly, operation, maintenance and repair.

The (P90) shall be constructed so that all assemblies, connectors, and interconnections are accessible for checking, adjustment, maintenance, and repair, with a minimum of disturbance to other parts and with a minimum quantity and variety of special tools.

D. RELIABILITY

Minuteman standard parts and proven design practices shall be utilized to their fullest extent to insure that the requirements of paragraph D of the Technical Requirements section are met.

E. APPLICABLE DOCUMENTS

Contractors applicable documents to be listed when available.

SUPPLEMENT TO FIGURE A

Technical Exceptions, Waivers, Deviations, and reasons in each case, are being separately submitted in the Dec. 13, 1962, revision to Enclosure (S) of NAA Letter 62AN/MM2600.

SUPPLEMENT 1 to Fig. A 6262

Deviations to AFBSD 62-83 shall be as follows:

Due to the cancellation of the survivability test program, the design requirements of AFBSD Exhibit 62-83 shall be considered as an objective rather than a requirement.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
AEROSPACE VEHICLE EQUIPMENT	SM-80 WEAPON SYSTEM	85002-306	AUTONETICS, A Division of North American Aviation, Inc.

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED MFR'S CODE (94756)	COMMON NOMENCLATURE	ORIGINATION DATE	AFBSD APP DATE	CONTRACT NO.
6263		THIRD STAGE NOZZLE CONTROL (P91)	2/7/62	3-11-63	AF04(694)-247

REVISIONS: REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	STOCK NUMBER: FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
	6A			NA				1									*** $44,000			CFE		12mo	W-6	Unclassified

I. TECHNICAL REQUIREMENTS

A requirement exists for the capability of changing the position of four moveable nozzles to obtain Thrust Vector Control for the purpose of controlling missile attitude in pitch, yaw, and roll.

A requirement exists for the use of specific types of major components as specified in paragraph 4.2.4.1.1.1 of AF/BSD Exhibit 62-58. (See Supplement I to this Figure A for exceptions).

A. FUNCTIONAL REQUIREMENTS

1. The P91 shall have the capability of moving the nozzles through an angular rotation of ± 4.0 degrees.
2. The P91 shall have the capability of moving the nozzles at a minimum rate of 10°/sec when the nozzles are loaded as specified in Appendix B of AF/BSD Exhibit 62-58.
3. The P91 shall put out a voltage proportional to nozzle position.
4. The crosstalk between channels shall be kept to a minimum.

WS-133B Form B

Reference Block No. 1, 12, 29

***The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE THIRD STAGE NOZZLE CONTROL P91

FIG A NUMBER 6263

PRELIMINARY DATA. NOT TO BE USED FOR PROCUREMENT

SHEET 1 OF 8

I. <u>TECHNICAL REQUIREMENTS</u>

B. <u>DESIGN CONSTRAINTS</u>

1. <u>Power</u>

a. <u>Ground Power:</u> The P91 shall be supplied by the following ground power sources. The voltages shall be measured at the appropriate umbilical.

(1) Electronic: $28 {}^{+2.0}_{-2.0}$ VDC (G&C Umbilical)

(2) Hydraulic: $28 {}^{+5.0}_{-1.0}$ VDC (Skirt Umbilical)

b. <u>Airborne Power:</u> The P91 electronics and the hydraulics will obtain their electrical power from a common third stage battery source with a voltage of $28 {}^{+2.0}_{-2.0}$ VDC

2. <u>Physical</u>

a. <u>Weight:</u> The P91 weight shall not exceed approximately 67 pounds such that the Third Stage Flight Control weight shall not exceed 111 pounds.

b. The (P91) dimensions shall be such as not to exceed the envelope specified in I.C.D. No. 25-38018 Stage III Nozzle Control Unit Envelope.

c. <u>Identification and Markings:</u> The (P91) shall be identified by a nameplate with the following information:

(1)	Nomenclature	(5)	Contract Number
(2)	Stock Number	(6)	Company Name
(3)	Serial Number	(7)	U.S.
(4)	Part Number		

3. <u>Interface</u>: The (P91) has the following electrical and physical interfaces

a. <u>Electrical:</u>

(1) P92 (Fig. A 6275)

(2) P95 (Fig. A 6274)

(3) G&C Airborne Battery (Fig. A 6210)

(4) Ground Power (Fig. A 13002)

I. <u>TECHNICAL REQUIREMENTS</u>

B. <u>DESIGN CONSTRAINTS</u> (Cont'd)

3. <u>Interface</u> (Cont'd)

b. <u>Physical</u>:

(1) P95 Cable Assembly (Fig. A 6274)

(2) Third Stage Motor

(3) Base Heat Deflector

4. <u>Environment</u>: The P91 shall be designed to withstand the following environments.

a. <u>Ambient</u>

(1) <u>Non-operative</u>

(a) Pressure - Altitude: As specified in paragraph 3.3.2 (a) and 3.3.3 (a) of AF/BSD Exhibit 62-51.

(b) Temperature: As specified in the applicable portions of paragraph 3.3.2 (b) and 3.3.3 (b) of AF/BSD Exhibit 62-51.

(c) Sunshine: As specified in paragraph 3.3.2 (c) of AF/BSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.2 (d) and 3.3.3 (e) of AF/BSD Exhibit 62-51.

(e) Wind-Borne Matter - (Rain, snow, hail, ice, sand and dust): As specified in paragraph 3.3.2 (e) and 3.3.3 (f) of AF/BSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.2 (f) and 3.3.3 (c) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.3 (d) of AF/BSD Exhibit 62-51.

(2) <u>Operative</u>

(a) Pressure - Altitude: As specified in the applicable paragraphs of AF/BSD Exhibit 62-83 and report AFCRC-TR-59-267. Also paragraph 3.3.1 (a) of AF/BSD Exhibit 62-51.(See Supp. I to this Fig. A for exceptions)

(b) Temperature: As specified in paragraph 3.3.4 (b) and 3.3.1 (b) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-69.

(c) Sunshine: As specified in paragraph 3.3.1 (c) of AF/BSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.1 (d) of AF/BSD Exhibit 62-51.

(e) Wind-Borne Matter: As specified in paragraph 3.3.1 (e) of AF/BSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.1 (f) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.1 (g) of AF/BSD Exhibit 62-51.

(h) Salt Atmosphere: As specified in paragraph 3.3.1 (g) of AF/BSD Exhibit 62-51.

(i) Radiation (Nuclear and Electromagnetic): As specified in the applicable paragraphs of AF/BSD Exhibit 62-87. Also paragraph 3.3.5 (c) of AF/BSD Exhibit 62-51.

I. TECHNICAL REQUIREMENTS

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

b. Dynamic

(1) Non-Operative

(a) Shock: As specified in paragraph 3.3.2 (g) in AF/BSD Exhibit 62-51.

(b) Vibration: As specified in paragraph 3.3.2 (h) in AF/BSD Exhibit 62-51.

(2) Operative

(a) Angular Oscillation: As specified in paragraph 3.3.5 (d) of AF/BSD Exhibit 62-51.

(b) Acoustic Field: As specified in paragraph 3.3.5 (c) of AF/BSD Exhibit 62-51.

(c) Sustained Acceleration: As specified in paragraph 3.3.5 (f) of AF/BSD Exhibit 62-51.

(d) Vibration: As specified in paragraph 3.3.5 (g) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

(e) Shock: As specified in paragraph 3.3.5 (h) and 3.3.1 (f) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

c. Electro-Interference: This equipment shall conform to the electro-interference requirements of AFBSD Exhibit 62-87.

5. Weapons Effects: The P91 shall be designed to withstand the applicable weapons effects environments called out in AF/BSD Exhibit 62-83. (See Supp. I to this Fig. A for exceptions)

6. Monitoring: All missile periodic and preflight checkout of the P91 will be done in conjunction with the P92 (Figure A, Item 6278).

7. Operating Life: The P91 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety Considerations: Safety considerations shall conform to the requirements of WS-133B Weapons System Safety Criteria, Minuteman BSD Exhibit 62- 2. (Referenced from AF/BSD Exhibit 62-58 paragraph 5.4.5)

9. Special Considerations: This equipment shall conform to the electrical grounding requirements of AFBSD Exhibit 62-75.

C. OPERABILITY AND MAINTAINABILITY: The (P91) shall conform to the applicable paragraphs of AF/BSD Exhibit 62-53 and AF/BSD Exhibit 61-99.

D. RELIABILITY: The (P91) reliability shall be in accordance with the apportionment of Exhibit "R" to the AF-04-(694)-247 Contract and shall conform to the applicable paragraphs of AF/BSD Exhibit 62-50.

I. TECHNICAL REQUIREMENTS

E. APPLICABLE DOCUMENTS

1. AF/BSD Exhibit 61-99: Human Engineering Design Criteria.
2. AF/BSD Exhibit 62-50: Reliability Design Criteria.
3. AF/BSD Exhibit 62-51: WS-133B, Environmental Design Criteria, Minuteman.
4. AF/BSD Exhibit 62-58: Design Criteria for WS-133B Guidance and Control System (Airborne and Ground). See Supplement I to this Figure A for details of the exceptions taken to this document.
5. AF/BSD Exhibit 62-77: Electrical Power and Cabling Subsystem Design Criteria
6. AF/BSD Exhibit 62-82: Weapon System Safety Criteria.
7. AF/BSD Exhibit 62-83: Weapon Effects Criteria (See Supp. I to this Fig. A for exceptions).
8. AF/BSD Exhibit 62-87: Electro Interference Control Requirements for Minuteman (WS-133B)
9. AF/BSD Exhibit 62-89: Packaging Preservation and Storage
10. AF/BSD Exhibit 62-53: Maintainability Design Criteria
11. AF/BSD Exhibit 62-75: Electrical Groundings

II. RECOMMENDED SOLUTION

It is recommended that the equipment designated as the Third Stage Nozzle Control Unit (P91) be designed and fabricated to fulfill the above TECHNICAL REQUIREMENTS. The Third Stage Nozzle Control Unit and its major components will have the following performance characteristics and physical description.

A. FUNCTIONAL DESCRIPTION

General: The P91 Third Stage Nozzle Control Unit operating in conjunction with the P92 shall provide a closed loop position serve for positioning the third stage nozzles. The P91 shall consist of the following major components: 1 Hydraulic Auxiliary Power Supply; 4 servo Cylinders.

1. Design and Construction: The design and construction of the Nozzle Control Unit shall be in accordance with Drawing and Part No. 25341-102.
2. Performance: The Nozzle Control Unit and its major components performance shall meet the following requirements:
   a. Actuator Limits: The Nozzle Control Actuator motion shall be mechanically limited to a total range of 0.892 (+0.000, -0.015) inch.

II. RECOMMENDED SOLUTION

A. FUNCTIONAL DESCRIPTION (Cont'd)

2. Performance (Cont'd)

b. Actuator Characteristics: Each Nozzle Control Actuator shall provide the following force velocity characteristics:

(1) 0 lb. load: 1.11 in./sec. minimum velocity

(2) 590 lb. load: 1.11 in./sec. minimum velocity

(3) 0 in./sec. velocity 990 lb minimum load

c. Hydraulic Pressure: The hydraulic pressure shall be 1500 (+215 - 135) psi.

d. Feedback Output Voltage Scale Factor: The output voltage scale factor shall be approximately 44.84 volts/in. with a NOMINAL 250 ohm output impedance.

e. Input-Feedback Output Gain: The minimum gain shall be approximately 6.23 volts/sec/milliampere for input currents less than 8 milliamperes.

f. Crosstalk: The crosstalk shall be such as not to interfere with the proper operation of other channels.

g. Insulation Resistance: The insulation resistance for power and signal leads shall be as specified in paragraph 2.1.5 of AF/BSD Exhibit 62-75.

B. DESIGN DESCRIPTION

1. Power

a. Ground Power: The P91 shall be supplied by the following ground power sources:

(1) Electronic: 28 ± 2.0 VDC (G&C Umbilical)

(2) Hydraulic: $28 {}^{+5.0}_{-1.0}$ VDC (Skirt Umbilical)

b. Airborne Power: The P91 electronics and hydraulics will obtain their electrical power from a common third stage battery source with a voltage of $28 {}^{+2.0}_{-2.0}$ VDC.

2. Physical

a. Weight: The weight of the Third Stage Nozzle Control Unit (P91) shall not exceed 67 pounds.

b. The P91 dimensions shall be in accordance with Drawing No. , but shall not exceed those specified in the Technical Requirements section.

II. RECOMMENDED SOLUTION

B. DESIGN DESCRIPTION (Cont'd)

2. Physical (Cont'd)

c. Identification and Markings: The (P91) shall be identified by a nameplate with the following information:

(1) Nomenclature

(2) Stock Number

(3) Serial Number

(4) Part Number

(5) Contract Number

(6) Company Name

(7) U.S.

3. Interface: The (P91) shall have the following Electrical and Physical Interfaces:

a. Electrical:

(1) The (P91) shall interface with the P92 in accordance with Drawing No.________.

(2) The (P91) shall interface with the P95 in accordance with Drawing No.________.

(3) The (P91) shall interface with the G&C Airborne Battery in accordance with AID No. 20040.

(4) The (P91) shall interface with the Ground Power in accordance with ICD No.________.

b. Physical

(1) The (P91) shall interface with the P95 in accordance with Drawing No.________.

(2) The (P91) shall interface with the Third Stage Motor in accordance with ICD No. 25-38050.

(3) The (P91) shall interface with the Base Heat Deflectors in accordance with ICD No.________.

4. Environmental: The (P91) design shall implement proven physical and electrical design techniques in accordance with Drawing No.________ to meet the following environmental requirements.

a. The (P91) shall be capable of operating satisfactorily (checkout or in-flight) during exposure to a natural combination of the operative, and after exposure to a natural combination of the non operative environments specified in the technical requirements.

b. The electro-interference characteristics of the (P91) shall be in accordance with the applicable paragraphs of AF/BSD Exhibit 62-87.

II. RECOMMENDED SOLUTION

B. DESIGN DESCRIPTION (Cont'd)

5. Weapons Effects: The (P91) shall be designed to withstand the applicable weapons effects environments called out in AF/BSD Exhibit 62-83. ((See Supp. I of this Fig. A for exceptions).

6. Monitoring: All missile periodic and preflight checkout of the P91 shall be done in conjunction with the P92.

7. Operating Life: The (P91) shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety Considerations: The (P91) shall be constructed to provide the greatest possible maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: None

C. OPERABILITY AND MAINTAINABILITY

The (P91) shall be constructed to minimize the skill, experience, and time necessary for its assembly, operation, maintenance and repair.

The (P91) shall be constructed so that all assemblies, connectors, and interconnections are accessible for checking, adjustment, maintenance, and repair with a minimum of disturbance to other parts and with a minimum quantity and variety of special tools.

D. RELIABILITY

Minuteman standard parts and proven design practices shall be utilized to their fullest extent to insure that the requirements of paragraph D of the Technical Requirements section are met.

E. APPLICABLE DOCUMENTS

Contractors applicable documents to be listed when available.

SUPPLEMENT I to Fig. A 6263

Deviations to AFBSD 62-83 shall be as follows:
Due to the cancelation of the survivability test program, the design requirements of AFBSD Exhibit 62-83 shall be considered as an objective rather than a requirement.

FIGURE A NUMBER 6263

TYPE OF LIST: AEROSPACE VEHICLE EQUIPMENT	MODEL DESIGNATION: SM-80 WEAPON SYSTEM	SUB SYSTEM IDENTIFICATION	CONTRACTOR: AUTONETICS, A Division of North American Aviation, Inc.
FIGURE A NUMBER: 6272	MILITARY NOMENCLATURE AND FED MFR'S CODE (94756)	COMMON NOMENCLATURE: CABLE ASSEMBLY (P93)	...NATION DATE: 11/29/62; AFBSD APP DATE: 341-63; CONTRACT NO. AF04(694)-247

REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	LF	LCF	MLCC	SMSB	SRA	MAMS		TOTAL ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4							5	6	7	8	9	10	11	12	12
	6A			NA				1								*** $6000.			CFE		31 Wks	W-6	Ref. Block 1, 37 (Provide cabling)

1. TECHNICAL REQUIREMENTS

A requirement exists for a means of transmitting electrical signals and power between P94 (Figure A, Item 6273) and P89 (Figure A, Item 6261) during missile flight and between P94, P89 and The First Stage Umbilical during ground checkout. An additional requirement exists per paragraph 4.2.6.1 of AFBSD Exhibit 62-58 that the P93 cable assembly form an integrated precision unit cable system with P94 and P95. (Figure A, Item 6274)

A. FUNCTIONAL REQUIREMENTS

1. The P93 shall be designed in such a manner as to diminish all detrimental electrical effects such as corona, crosstalk, noise coupling effects, shielding, attenuation, distortion and grounding which interferes with proper signal or power transmission in the cable conductors.

2. The P93 grounding shall conform with the applicable portions of the following paragraphs of AFBSD Exhibit 62-75.

a. 2.1.2.
b. 2.1.4.
c. 2.1.6.
d. 2.2.2.
e. 2.2.3.
f. 2.2.4.

*** The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE CABLE ASSEMBLY STAGE - I

FIG A NUMBER 6272

PRELIMINARY DATA: NOT TO BE USED FOR PROCUREMENT

SHEET 1 OF 8

I. TECHNICAL REQUIREMENTS (Cont'd)

A. FUNCTIONAL REQUIREMENTS (Cont'd)

3. Special consideration shall be given to voltages impressed on exposed connector pins after breakaway.

B. DESIGN CONSTRAINTS

1. Power: The P93 shall be capable of conducting all electrical power necessary for missile flight and ground checkout.

2. Physical: The P93 shall have the following physical limitations:

a. Weight: The P93 weight shall not exceed approximately (45) pounds such that the First Stage Flight Control weight shall not exceed (210) pounds.

b. Dimensions: The P93 dimensions shall be such as not to exceed the envelope specified in ICD No. 25-16359 (Stage I Guidance and Control Cable Envelope).

c. Connectors: The P93 shall utilize connectors qualified to MIL-C-26500. Where special conditions necessitate the use of other connectors, all terminals shall be of the crimped-type except those employed in hermetic seal connectors.

d. The cable layout shall be such that sharp bends and points of tensile and shear stress are avoided.

e. Identification and Markings: The P93 shall be identified by a nameplate with the following information.

(1) Nomenclature
(2) Stock number
(3) Serial number
(4) Part number
(5) Contract number
(6) Company name
(7) U S

3. Interface: The P93 has the following electrical and physical interfaces:

a. Electrical:

(1) P89 (Figure A, Item 6261)
(2) P94 (Figure A, Item 6273)
(3) First Stage Umbilical
(4) First Stage Engine

b. Physical:

(1) P89 (Figure A, Item 6261)
(2) P94 (Figure A, Item 6273)
(3) First Stage Umbilical
(4) First Stage Engine

FIGURE A NUMBER 6272
SHEET 2 OF 8

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental: The P93 Cable Assembly shall be designed to withstand the following environments.

a. Ambient

(1) Non-operative

(a). Pressure - Altitude: As specified in para. 3.3.2.(a) and 3.3.3. (a) of AF/BSD Exhibit 62-51.

(b) Temperature: As specified in the applicable portions of para. 3.3.2 (b) and 3.3.3 (b) of AF/BSD Exhibit 62-51.

(c) Sunshine: As specified in para. 3.3.2 (c) of AF/BSD Exhibit 62-51.

(d) Wind: As specified in para. 3.3.2 (d) and 3.3.3 (e) of AF/BSD Exhibit 62-51

(e) Wind: Borne Matter (Rain, snow, hail, ice, sand & dust): As specified in para 3.3.2 (e) and 3.3.3 (f) of AF/BSD Exhibit 62-51.

(f) Humidity: As specified in para. 3.3.2 (f) and 3.3.3 (c) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified; in para. 3.3.3 (d) of AF/BSD Exhibit 62-51.

(2) Operative

(a) Pressure - Altitude: As specified in the applicable paragraph of AF/BSD Exhibit 62-83 and report AFCRC - TR - 59-267. Also para. 3.3.1 (a) of AF/BSD Exhibit 62-51.

(b) Temperature: As specified in para. 3.3.4 (b) and 3.3.1 (b) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD Exhibit 62-69.

(c) Sunshine: As specified in para. 3.3.1 (c) of AF/BSD Exhibit 62-51.

(d) Win±: As specified in para. 3.3.1 (d) of AF/BSD Exhibit 62-51.

(e) Wind: Borne Matter - As specified in para. 3.3.1 (e) of AF/BSD Exhibit 62-51.

(f) Humidity: As specified in para. 3.3.1 (f) of AF/BSD Exhibit 62-51.

(g) Fungus Growth: As specified in para. 3.3.1 (g) of AF/BSD Exhibit 62-51.

(h) Salt Atmosphere: As specified in para. 3.3.1 (g) of AF/BSD Exhibit 62-51.

(i) Radiation (Nuclear and Electromagnetic): As specified in the applicable paragraphs of AF/BSD Exhibit 62-83 also para. 3.3.5 (c) of AF/BSD Exhibit 62-51.

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

b. Dynamic

(1) Non-Operative

(a) Shock: As specified in paragraph 3.3.2 (g) in AF/BSD Exhibit 62-51.

(b) Vibration: As specified in paragraph 3.3.2 (h) in AF/BSD Exhibit 62-51.

(2) Operative

(a) Angular Oscillation: As specified in paragraph 3.3.5 (d) of AF/BSD Exhibit 62-51.

(b) Acoustic Field: As specified in paragraph 3.3.5 (e) of AF/BSD Exhibit 62-51.

(c) Sustained Acceleration: As specified in paragraph 3.3.5 (f) of AF/BSD Exhibit 62-51.

(d) Vibration: As specified in paragraph 3.3.5 (g) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD 62-83.

(e) Shock: As specified in paragraph 3.3.5 (h) and 3.3.1 (i) of AF/BSD Exhibit 62-51 and the applicable paragraphs of AF/BSD 62-83.

c. Electro-Interference: This equipment shall conform to the applicable electro-interference requirements of AF/BSD Exhibit 62-87.

5. Weapons effects: The P93 shall be designed to withstand the applicable weapons effects environments called out in AF/BSD Exhibit 62-83.

6. Monitoring: Not applicable.

7. Operating Life: The P93 shall be capable of operating in the readiness condition for a period of at least three years without encontering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety considerations: The P93 shall be constructed to provide, to the greatest extent possible, maximum safety to personnel while installing, operating, and maintaining it.

9. Special considerations: Not applicable.

I. TECHNICAL REQUIREMENTS (Cont'd)

C. OPERABILITY AND MAINTAINABILITY: The (P93) shall conform to the applicable paragraphs of AFBSD Exhibit 62-53 and AFBSD Exhibit 61-99.

D. RELIABILITY: The P93 reliability shall be in accordance with its apportionment of Exhibit "R" to the AF-04(694)-247 Contract, and shall conform to the applicable paragraphs of AFBSD Exhibit 62-50.

E. APPLICABLE DOCUMENTS

1. AFBSD Exhibit 61-99: Human Engr. Design Criteria.
2. AFBSD Exhibit 62-50: Reliability Design Criteria.
3. AFBSD Exhibit 62-51: WS-133B, Environmental Design Criteria, Minuteman.
4. AFBSD Exhibit 62-58: Design Criteria for WS-133B Guidance and Control System (Airborne and Ground).
5. AFBSD Exhibit 62-77: Electrical Power and Cabling Subsystem Design Criteria.
6. AFBSD Exhibit 62-82: Weapon System Safety Criteria.
7. AFBSD Exhibit 62-83: Weapon Effects Criteria.
8. AFBSD Exhibit 62-87: Electro Interference Control Requirements for Minuteman (WS-133B).
9. AFBSD Exhibit 62-89: Packaging Preservation and Storage.
10. AFBSD Exhibit 62-53: Maintainability Design Criteria.
11. AFBSD Exhibit 62-75: Electrical Grounding.

FIGURE A NUMBER 6272
SHEET 5 OF 8

II. RECOMMENDED SOLUTION

It is recommended that the equipment designated as the First Stage cable assembly P93 be designed and fabricated to fulfill the foregoing Technical Requirements.

A. FUNCTIONAL DESCRIPTION

General:. The P93 cable assembly when used in conjunction with the P94 Figure A, Item 6273, and P95', Figure A, Item 6274 shall form an integrated precision unit cable system to carry missile electrical signals and power.

1. The design and construction of the P93 cable assembly shall be in accordance with Drawing NA 5-15864 ________.

   a. The design and construction shall implement measures to minimize all detrimental electrical effects called out in I. A. 1 of the Technical Requirements.

   b. The design and construction shall implement measures to conform to the grounding criteria called out in I. A. 2 of the Technical Requirements.

   c. Cable Connector dead facing shall be used to protect critical circuits after breakaway.

2. The P93 cable assembly shall have the following performance characteristics.

   a. The P93 cable assembly circuit continuity shall be as shown in Drawing NA 5-15864 -27

   b. The P93 cable assembly shall have the following insultation resistance characteristics.

      (1) The insulation resistance between any two non-shielded conductors shall be a minimum of 100 megohms.

      (2) The insulation resistance between any two conductors within a shielded multiple conductor cable, or between any conductor and its shield, shall be a minimum of 100 megohms.

      (3) The insulation resistance between any two shields shall be an absolute minimum of 20 megohms.

   c. The maximum resistance between connector pins shall not be such that the maximum known current through the conductor will present a voltage drop detrimental to the proper functioning of the system.

B. DESIGN DESCRIPTION

1. Power: The P93 shall be capable of conducting all electrical power necessary for missile flight and ground checkout.

2. Physical: .

   a. Weight: The weight of the First Stage cable assembly P93 shall not exceed 45 pounds.

   b. Dimensions, connectors and cable layout shall be in accordance with Drawing NA 5-15864 but the dimensions shall not exceed those specified in the Technical Requirements, and I. C. D. No. 25-16359.

II. __RECOMMENDED SOLUTION__ (Cont'd)

B. __DESIGN DESCRIPTION__ (Cont'd)

c. __Identification and Markings:__ The P93 shall be identified by a nameplate with the following information.

(1) Nomenclature
(2) Stock Number
(3) Serial Number
(4) Part Number
(5) Contract Number
(6) Company Name
(7) U. S.

3. __Interface__: The P93 shall have the following Electrical and Physical Interfaces.

a. __Electrical:__

(1) The P93 shall interface with the P89, Figure A, Item 6261 in accordance with Drawing 25350-102.
(2) The P93 shall interface with the P94, Figure A, Item 6273 in accordance with Drawing 25350-102.
(3) The P93 shall interface with the First Stage Umbilical in accordance with Drawing 25350-102.
(4) The P93 shall interface with the First Stage Motor in accordance with Drawing 25350-102.

b. __Physical:__

(1) The P93 shall interface with the P89, Figure A, Item 6261 in accordance with Drawing NA5-15864.
(2) The P93 shall interface with the P94, Figure A, Item 6273 in accordance with Drawing NA5-15864.
(3) The P93 shall interface with the First Stage Umbilical in accordance with Drawing NA5-15864.
(4) The P93 shall interface with the First Stage Motor in accordance with ICD 25-15417.
(5) The P93 shall interface with the First Stage Motor in accordance with Drawing 25350-102.

4. __Environmental__: The P93 design shall implement proven physical and electrical design techniques in accordance with Drawing NA5-15864 to meet the following environmental requirements.

a. The P93 shall be capable of operating satisfactorily (checkout of in-flight) during exposure to a natural combination of the operative and after exposure to a natural combination of the non operative environments specified in the Technical Requirements.

b. The electro-interference characteristics of the P93 shall be in accordance with the applicable paragraphs of AF/BSD Exhibit 62-87.

FIGURE A NUMBER 6272

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

5. Weapons Effects: The P93 shall be designed to withstand the applicable weapons effects environments called out in AF/BSD Exhibit 62-83.

6. Monitoring: Not applicable.

7. Operating Life: The P93 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts, or similar problems of aging.

8. Safety Considerations: The P93 shall be constructed to provide the greatest possible maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: None

C. OPERABILITY AND MAINTAINABILITY

The P93 shall be constructed to minimize the skill, experience, and time necessary for its assembly, operation, maintenance and repair.

The P93 shall be constructed so that all assemb lies, connectors, and interconnections are accessible for checking, adjustment, maintenance, and repair, with a minimum of disturbance to other parts and with a minimum quantity and variety of special tools.

D. RELIABILITY

Minuteman Standard Parts and proven design practices shall be utilized to ensure that the requirements of the Technical Requirements section are met.

E. APPLICABLE DOCUMENTS

The same as specified in the Technical Requirements.

FIGURE A NUMBER 6272
SHEET 8 OF 8

TYPE OF LIST: AEROSPACE VEHICLE EQUIPMENT	MODEL DESIGNATION: SM-80 WEAPON SYSTEM	SUB SYSTEM IDENTIFICATION	CONTRACTOR: AUTONETICS, A Division of North American Aviation, Inc.
FIGURE A NUMBER: 6273	MILITARY NOMENCLATURE AND FED MFR'S CODE	COMMON NOMENCLATURE: CABLE ASSEMBLY (P94)	ORIGINATION DATE: 12/15/62; AFBSD APP DATE: 3-11-63; CONTRACT NO.: AF04(694)-247

REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN AB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	1ST PROD LEAD TIME	1ST ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
																	***							
	6A			NA				1									$8000.00			CFE		7 Mo	W-6	Ref. Block L 57 (Provide Cabling)

I. TECHNICAL REQUIREMENTS - A requirement exists for a means of transmitting electrical signals and power between P93 and P95 during missile flight and ground checkout. An additional requirement exists per paragraph 4.2.6.1 of AFBSD Exhibit 62-58 that the P94 cable assembly form an integrated precision unit cable system with P93 and P95.

A. FUNCTIONAL REQUIREMENTS

1. The P94 shall be designed in such a manner as to diminish all detrimental electrical effects such as corona, crosstalk, noise coupling effects, shielding, attenuation, distortion and grounding which interferes with proper signal or power transmission in the cable conductors.

2. The P94 grounding shall conform with the applicable portions of the following paragraphs of AFBSD Exhibit 62-75.

a. 2.1.2.

b. 2.1.4.

c. 2.1.6.

d. 2.2.2.

e. 2.2.3.

f. 2.2.4.

***The Estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE CABLE ASSEMBLY STAGE II

FIG A NUMBER 6273

PRELIMINARY DATA: NOT TO BE USED FOR PROCUREMENT

I. TECHNICAL REQUIREMENTS (Cont'd)

A. FUNCTIONAL REQUIREMENTS (Cont'd)

3. Special consideration shall be given to voltages impressed on exposed connector pins after breakaway.

B. DESIGN CONSTRAINTS

1. Power: The P94 shall be capable of conducting all electrical power necessary for missile flight and ground checkout.

2. Physical: The P94 shall have the following physical limitations:

a. Weight: The P94 weight shall not exceed approximately 35 pounds such that the second stage flight control weight shall not exceed 104.4 pounds.

b. Dimensions: The P94 dimensions shall be such as not to exceed the envelope specified in ICD 25-16360 (Stage II Guidance and Control Cable Envelope).

c. Connectors: The P94 shall utilize connectors qualified to MIL-C-26500. Where special conditions necessitate the use of other connectors, all terminals shall be of crimped-type except those employed in hermetic seal connectors.

d. The cable layout shall be such that sharp bends and points of tensile and shear stress are avoided.

e. Identification and Markings: The P94 shall be identified by a nameplate with the following information.

(1) Nomenclature

(2) Stock number

(3) Serial number

(4) Part number

(5) Contract number

(6) Company name

(7) USE

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

3. Interface: The P94 has the following electrical and physical interfaces.

a. Electrical

(1) P90 Liquid Thrust Vector Control Unit (Fig. A No. 6262)

(2) P93 Cable Assembly (Fig. A No. 6272)

(3) P95 Cable Assembly (Fig. A No. 6274)

(4) P68 Angular Accelerometer Unit (Fig. A No. 6202)

b. Physical

(1) P90 Liquid Thrust Vector Control Unit (Fig. A No. 6262)

(2) P93 Cable Assembly (Fig. A No. 6272)

(3) P95 Cable Assembly (Fig. A No. 6274)

(4) Second Stage Engine

(5) P68 Angular Accelerometer Unit (Fig. A No. 6202)

4. Environmental: The P94 Cable Assembly shall be designed to withstand the following environments:

a. Ambient

(1) Non-operative

(a) Pressure - Altitude: As specified in para. 3.3.2 (a) of AFBSD Exhibit 62-51.

(b) Temperature: As specified in the applicable portions of para. 3.3.2 (b) and 3.3.3 (b) of AFBSD Exhibit 62-51.

(c) Sunshine: As specified in para. 3.3.2 (c) of AFBSD Exhibit 62-51.

(d) Wind: As specified in para. 3.3.2 (d) and 3.3.3 (a) of AFBSD Exhibit 62-51.

(e) Wind-Borne Matter (Rain, snow, hail, ice, sand and dust): As specified in para. 3.3.2 (e) and 3.3.3 (f) of AFBSD Exhibit 62-51.

(f) Humidity: As specified in para. 3.3.2 (f) and 3.3.3 (c) of AFBSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.3 (d) of AFBSD Exhibit 62-51.

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

a. Ambir (Cont'd)

(2) Operative

(a) Pressure - Altitude: As specified in the applicable paragraphs of AFBSD Exhibit 62-83 and report AFCRC - TR -59-267, also para. 3.3.1 (a) of AFBSD Exhibit 62-51.

(b) Temperature: As specified in para. 3.3.4 (b) and 3.3.1 (b) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-69.

(c) Sunshine: As specified in para. 3.3.1 (c) of AFBSD Exhibit 62-51.

(d) Wind: As specified in para. 3.3.1 (d) of AFBSD Exhibit 62-51.

(e) Wind-Borne Matter: As specified in para. 3.3.1 (e) of AFBSD Exhibit 62-51.

(f) Humidity: As specified in para. 3.3.1 (f) of AFBSD Exhibit 62-51.

(g) Fungus Growth: As specified in para. 3.3.1 (g) of AFBSD Exhibit 62-51.

(h) Salt Atmosphere: As specified in para. 3.3.1 (g) of AFBSD Exhibit 62-51.

(i) Radiation (Nuclear and Electromagnetic): As specified in the applicable paragraphs of AFBSD Exhibit 62-83 also para. 3.3.5 (c) of AFBSD Exhibit 62-51.

b. Dynamic

(1) Non-Operative

(a) Shock: As specified in para. 3.3.2 (g) in AFBSD Exhibit 62-51.

(b) Vibration: As specified in para. 3.3.2 (h) in AFBSD Exhibit 62-51.

(2) Operative

(a) Angular Oscillation: As specified in para. 3.3.5 (d) of AFBSD Exhibit 62-51.

(b) Acoustic Field: As specified in para. 3.3.5 (e) of AFBSD Exhibit 62-51.

(c) Sustained ! Acceleration: As specified in para. 3.3.5 (f) of AFBSD Exhibit 62-51.

I. TECHNICAL REQUIREMENTS (Cont'd

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

b. Dynamic (Cont'd)

(2) Operative (Cont'd)

(d) Vibration: As specified in para. 3.3.5 (g) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-83.

(e) Shock: As specified in para. 3.3.5 (h) and 3.3.1 (i) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-83.

c. Electro-Interference: The equipment shall conform to the applicable electro-interference requirements of AFBSD Exhibit 62-87.

5. Weapons effects: The P94 shall be designed to withstand the applicable weapons effects environments called out in AFBSD Exhibit 62-83.

6. Monitoring: Not Applicable

7. Operating Life: The P94 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety considerations: The P94 shall be constructed to provide, to the greatest extent possible, maximum safety to personnel while installing, operating, and maintaining it.

9. Special considerations: Not Applicable

C. OPERABILITY AND MAINTAINABILITY: The P94 shall conform to the applicable paragraphs of AFBSD Exhibit 62-53 and AFBSD Exhibit 61-99.

D. RELIABILITY: The P94 reliability shall be in accordance with its apportionment of Exhibit "R" to the AF04(694)-247 contract, and shall conform to the applicable paragraphs of AFBSD Exhibit 62-50.

E. APPLICABLE DOCUMENTS

1. AFBSD Exhibit 61-99: Human Engr. Design Criteria.
2. AFBSD Exhibit 62-50: Reliability Design Criteria.
3. AFBSD Exhibit 62-51: WS-133B, Environmental Design Criteria, Minuteman.
4. AFBSD Exhibit 62-58: Design Criteria for WS-133B, Guidance and Control System (Airborne and Ground).

I. TECHNICAL REQUIREMENTS (Cont'd)

E. APPLICABLE DOCUMENTS (Cont'd)

5. AFBSD Exhibit 62-77: Electrical Power and Cabling Subsystem Design Criteria.

6. AFBSD Exhibit 62-82: Weapon System Safety Criteria.

7. AFBSD Exhibit 62-83: Weapon Effects Criteria.

8. AFBSD Exhibit 62-87: Electro Interference Control Requirements for Minuteman (WS-133B).

9. AFBSD Exhibit 62-89: Packaging Preservation and Storage.

10. AFBSD Exhibit 62-53: Maintainability Design Criteria.

11. AFBSD Exhibit 62-75: Electrical Grounding.

FIGURE A NUMBER 6273
SHEET 6 OF 9

II. RECOMMENDED SOLUTION

It is recommended that the equipment designated as the Second Stage cable assembly (P94) be designed and fabricated to fulfill the foregoing technical requirements.

A. FUNCTIONAL DESCRIPTION

General - The P94 cable assembly when used in conjection with the P93 and P95 shall form an integrated precision unit cable system to carry electrical signals and power.

1. The design and construction of the P94 cable assembly shall be in accordance with Drawing NA5-15865.
   - a. The design and construction shall implement measures to minimize all detrimental electrical effects called out in I.A.1. of the Technical Requirements.
   - b. The design and construction shall implement measures to conform to the grounding criteria called out in I.A.2. of the Technical Requirements.
   - c. Cable Connector dead-facing shall be used to protect critical circuits after breakaway.
2. The P94 cable assembly shall have the following performance characteristics.
   - a. The P94 cable assembly circuit continuity shall be as shown on Drawing NA5-15865.
   - b. The P94 cable assembly shall have the following insulation resistance characteristics.
     - (1) The insulation resistance between any two non-shielded conductors shall be a minimum of 100 megohms.
     - (2) The insulation resistance between any two conductors within a shielded multiple conductor cable, or between any conductor and its shield, shall be a minimum of 100 megohms.
     - (3) The insulation resistance between any two shields shall be an absolute minimum of 20 megohms.
   - c. The maximum resistance between connector pins shall not be such that the maximum known current through the conductor will present a voltage drop detrimental to the proper functioning of the system.

B. DESIGN DESCRIPTION

1. Power: The P94 shall be capable of conducting all electrical power necessary for missile flight and ground checkout.
2. Physical:
   - a. Weight: The weight of the Second Stage cable assembly P94 shall not exceed 35 pounds.

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

2. Physical (Cont'd)

b. Dimensions, connectors, and cable layout shall be in accordance with Drawing NA5-15865, but the dimensions shall not exceed those specified in the Technical Requirements, and ICD 25-16360.

c. Identification and Markings: The P94 shall be identified by a nameplate with the following information.

(1) Nomenclature
(2) Stock Number
(3) Serial Number
(4) Part Number
(5) Contract Number
(6) Company Name
(7) U. S.

3. Interface: The P94 shall have the following Electrical and Physical Interfaces.

a. Electrical:

(1) The P94 shall interface with the P90 in accordance with Drawing 25352-102.
(2) The P94 shall interface with the P93 in accordance with Drawing 25352-102.
(3) The P94 shall interface with the P95 in accordance with Drawing 25352-102.
(4) The P94 shall interface with the P68 in accordance with Drawing 25352-102.

b. Physical:

(1) The P94 shall interface with the P90 in accordance with Drawing NA5-15865.
(2) The P94 shall interface with the P93 in accordance with Drawing NA5-15865.
(3) The P94 shall interface with the P95 in accordance with Drawing NA5-15865.
(4) The P94 shall interface with the P68 in accordance with Drawing NA5-15865.
(5) The P94 shall interface with the Second Stage Engine in accordance with ICD 25-15407.

II. RECOMMENDED SOLUTIONS (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

4. Environmental: The P94 design shall implement proven physical and electrical design techniques in accordance with Drawing NA 5-15865 to meet the following environmental requirements.

   a. The P94 shall be capable of operating satisfactorily (checked or in-flight) during exposure to a natural combination of the operative and after exposure to a natural combination of the non-operative environments specified in the technical requirements.

   b. The electro-interference characteristics of the P94 shall be in accordance with the applicable paragraphs of AFBSD Exhibit 62-87.

5. Weapons Effects: The P94 shall be designed to withstand the applicable weapons effects environments called out in AFBSD Exhibit 62-83.

6. Monitoring: Not Applicable

7. Operating Life: The P94 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety Considerations: The P94 shall be constructed to provide the greatest possible maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: None

C. OPERABILITY AND MAINTAINABILITY

The P94 shall be constructed to minimize the skill, experience, and time necessary for its assembly, operation, maintainance and repair.

The P94 shall be constructed so that all assemblies, connectors, and interconnections are accessible for checking, adjustment, maintainance, and repair, with a minimum of disturbance to other parts wnd with a minimum quantity and variety of special tools.

D. RELIABILITY: MINUTEMAN standard parts and proven design practices shall be utilized to ensure that the requirements of paragraph D of the Technical Requirements section are met.

E. APPLICABLE DOCUMENTS

The same as specified in the Technical Requirements.

TYPE OF LIST: AEROSPACE VEHICLE EQUIPMENT	MODEL DESIGNATION: SM-80 WEAPONS SYSTEM	SUB SYSTEM IDENTIFICATION:	CONTRACTOR: AUTONETICS, A Division of North American Aviation, Inc.
FIGURE A NUMBER: 6274	MILITARY NOMENCLATURE AND FED MFR'S CODE:	COMMON NOMENCLATURE: CABLE ASSEMBLY (P95)	ORIGINATION DATE: 1/29/62; AFBSD APP DATE: 3-11-63; CONTRACT NO.: AF04(694)-247

REVISIONS: REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	STOCK NUMBER: FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
	6A			NA				1									*** $7000.00			CFE		31WK	W-6	Ref: Block 1.37 (Provide cabling)

1. TECHNICAL REQUIREMENTS

A requirement exists for a means of transmitting electrical signals and power between P94, Figure A, Item 6273 & P92, Figure A, Item 6275 during missile flight and ground checkout. An additional requirement exists per paragraph 4.2.6.1 of AFBSD Exhibit 62-58 that the P95 cable assembly form an integrated precision unit cable system with P93, Figure A, Item 6272 and P94.

A. FUNCTIONAL REQUIREMENTS

1. The P95 shall be designed in such a manner as to diminish all detrimental electrical effects such as corona, crosstalk, noise coupling effects, shielding, attenuation, distortion and grounding which interferes with proper signal or power transmission in the cable conductors.

2. The P95 gounding shall conform with the applicable portions of the following paragraphs of AFBSD Exhibit 62-75.

   a. 2.1.2.
   b. 2.1.4.
   c. 2.1.6.
   d. 2.2.2.
   e. 2.2.3.
   f. 2.2.4.

3. Special consideration shall be given to voltages impressed on exposed connector pins after breakaway.

***The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE CABLE ASSEMBLY (P95) FIG A NUMBER 6274

PRELIMINARY DATA: NOT TO BE USED FOR PROCUREMENT

SHEET 1 OF 1

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS

1. Power: The P95 shall be capable of conducting all electrical power necessary for missile flight and ground checkout.

2. Physical: The P95 shall have the following physical limitations:

   a. Weight: The P95 weight shall not exceed approximately 25.0 pounds such that the Third Stage Flight Control weight shall not exceed 111 pounds.

   b. Dimensions: The P95 dimensions shall be such as not to exceed the Envelope specified in ICD 25-16374 (Stage III Guidance and Control Cable Envelope).

   c. Connectors: The P95 shall utilize connectors qualified to MIL-C-26500. Where special considerations necessitate the use of other connectors all Terminals shall be of the crimped type except those employed in hermetic seal connectors.

   d. The cable Layout shall be such that sharp bends and points of Tensile and shear stress are avoided.

   e. Identification and Markings: The P95 shall be identified by a nameplate with the following information:

      (1) Nomenclature

      (2) Stock Number

      (3) Serial Number

      (4) Part Number

      (5) Contract Number

      (6) Company Name

      (7) U S

3. Interface: The P95 has the following electrical and physical interfaces.

   a. Electrical:

      (1) P91 Nozzle Control Unit (Fig. A. No. 6263)

      (2) P94 Cable Assembly (Fig. A. No. 6273)

      (3) P92 Control Discrete Unit (P/O Fig. A. 6275)

      (4) Third Stage Engine

   b. Physical:

      (1) P91 Nozzle Control Unit (Fig. A. No. 6263)

      (2) P94 Cable Assembly (Fig. A. No. 6273)

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

3. Interface (Cont'd)

(3) P92 Control Discrete Unit (P/O Fig. A. 6275)

(4) Third Stage Engine

4. Environmental: The P95 cable assembly shall be designed to withstand the following environments.

a. Ambient

(1) Non-operative

(a) Pressure - Altitude: As specified in paragraph 3.3.2 (a) and 3.3.3 (a) of AFBSD Exhibit 62-51.

(b) Temperature: As specified in the applicable portions of paragraph 3.3.2 (b) and 3.3.3 (b) of AFBSD Exhibit 62-51.

(c) Sunshine: As specified in paragraph 3.3.2 (c) of AFBSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.2 (d) and 3.3.3 (e) of AFBSD Exhibit 62-51.

(e) Wind-Borne Matter (Rain, snow, hail, ice, sand and dust): As specified in paragraph 3.3.2 (e) and 3.3.3 (f) of AFBSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.2 (f) and 3.3.3 (c) of AFBSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.3 (d) of AFBSD Exhibit 62-51.

(2) Operative

(a) Pressure - Altitude: As specified in the applicable paragraphs of AFBSD Exhibit 62-83, and report AFCRC - TR-59-267. Also paragraph 3.3.1 (a) of AFBSD Exhibit 62-51.

(b) Temperature: As specified in paragraph 3.3.4 (b) and 3.3.1 (b) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD 62-69.

(c) Sunshine: As specified in paragraph 3.3.1 (c) of AFBSD Exhibit 62-51.

(d) Wind: As specified in paragraph 3.3.1 (d) of AFBSD Exhibit 62-51.

(e) Wind - Borne Matter: As specified in paragraph 3.3.1 (e) of AFBSD Exhibit 62-51.

(f) Humidity: As specified in paragraph 3.3.1 (f) of AFBSD Exhibit 62-51.

(g) Fungus Growth: As specified in paragraph 3.3.1 (g) of AFBSD Exhibit 62-51.

(h) Salt Atmosphere: As specified in paragraph 3.3.1 (g) of AFBSD Exhibit 62-51.

(i) Radiation (Nuclear and Electromagnetic): As specified in the applicable paragraphs of AFBSD Exhibit 62-83. Also paragraph 3.3.5 (c) of AFBSD Exhibit 62-51.

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental (Cont'd)

b. Dynamic

(1) Non-Operative

(a) Shock: As specified in paragraph 3. 3. 2 (g) in AFBSD Exhibit 62-51.

(b) Vibration: As specified in paragraph 3. 3. 2 (h) in AFBSD Exhibit 62-51.

(2) Operative

(a) Angular Oscillator: As specified in paragraph 3. 3. 5 (d) of AFBSD Exhibit 62-51.

(b) Acoustic Field: As specified in paragraph 3. 3. 5 (e) of AFBSD Exhibit 62-51.

(c) Sustained Acceleration: As specified in paragraph 3. 3. 5 (f) of AFBSD Exhibit 62-51.

(d) Vibration: As specified in paragraph 3. 3. 5 (g) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-83.

(e) Shock: As specified in paragraph 3. 3. 5 (h) and 3. 3. 1 (f) of AFBSD Exhibit 62-51 and the applicable paragraphs of AFBSD Exhibit 62-83.

c. Electro-Interference: This equipment shall conform to the applicable electro-interference requirements of AFBSD Exhibit 62-87.

5. Weapons Effects: The P95 shall be designed to withstand the applicable weapons effects environments called out in AFBSD Exhibit 62-83.

6. Monitoring: Not Applicable.

7. Operating Life: The P95 shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts or similar problems of aging.

8. Safety Considerations: The P95 shall be constructed to provide, to the greatest extent possible, maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: Not Applicable.

C. OPERABILITY AND MAINTAINABILITY: The P95 shall conform to the applicable paragraphs of AFBSD Exhibit 62-53 and AFBSD Exhibit 61-99.

D. RELIABILITY: The P95 reliability shall be in accordance with its apportionment of Exhibit "R" to the AF04(694)-247 contract, and shall conform to the applicable paragraphs of AFBSD Exhibit 62-50.

E. APPLICABLE DOCUMENTS

1. AFBSD Exhibit 6-99: Human Engineering Design Criteria
2. AFBSD Exhibit 62-50: Reliability Design Criteria

I. TECHNICAL REQUIREMENTS (Cont'd)

E. APPLICABLE DOCUMENTS (Cont'd)

3. AFBSD Exhibit 62-51: WS-133B, Environmental Design Criteria, Minuteman
4. AFBSD Exhibit 62-58: Design Criteria for WS-133B Guidance and Control System (Airborne and Ground)
5. AFBSD Exhibit 62-77: Electrical Power and Cabling Subsystem Design Criteria
6. AFBSD Exhibit 62-82: Weapon System Safety Criteria
7. AFBSD Exhibit 62-83: Weapon Effects Criteria
8. AFBSD Exhibit 62-87: Electro Interference Control Requirements for Minuteman (WS-133B)
9. AFBSD Exhibit 62-89: Packaging Preservation and Storage
10. AFBSD Exhibit 62-58: Maintainability Design Criteria.
11. AFBSD Exhibit 62-75: Electrical Grounding

II. RECOMMENDED SOLUTION

It is recommended that the equipment designated as the Third Stage cable assembly P95 be designed and fabricated to fulfill the above Technical Requirements.

A. FUNCTIONAL DESCRIPTION

General: The P95 cable assembly when used in conjunction with the P93 and P94 shall form an integrated precision unit cable system to carry missile electrical signals and power.

1. The design and construction of the P95 cable assembly shall be in accordance with Drawing NA 5 - 15866

   a. The design and construction shall implement measures to minimize all detrimental electrical effects called out in I. A. 1 of the Technical Requirements.

   b. The design and construction shall implement measures to conform to the grounding criteria called out in I. A. 2 of the Technical Requirements.

   c. Cable Connector dead facing shall be used to protect critical circuits after breakaway.

2. The P95 cable assembly shall have the following performance characteristics.

   a. The P95 cable assembly circuit continuity shall be as shown on Drawing NA 5 - 15866

   b. The P95 cable assembly shall have the following insulation resistance characteristics.

II. RECOMMENDED SOLUTION (Con'd)

A. FUNCTIONAL DESCRIPTION (Con'd)

(1) The insulation resistance between any two non-shielded conductors shall be a minimum of 100 megohms.

(2) The insulation resistance between any two conductors within a shielded multiple conductor cable, or between any conductor and its shield, shall be a minimum of 100 megohms.

(3) The insulation resistance between any two shields shall be an absolute or minimum at 20 megohms.

c. The maximum resistance between connector pins shall not be such that the maximum known current through the connector will present a voltage drop detrimental to the proper functioning of the system.

B. DESIGN DESCRIPTION

1. Power: The P95 shall be capable of conducting all electrical power necessary for missile flight and checkout.

2. Physical:

a. Weight: The weight of the (Third Stage) cable assembly (P95) shall not exceed 25.0 pounds.

b. Dimensions: Connectors and cable layout shall be in accordance with Drawing NA5-15866.

c. Identification and Markings: The (P95) shall be identified by a nameplate with the following information.

(1) Nomenclature
(2) Stock Number
(3) Serial Number
(4) Part Number
(5) Contract Number
(6) Company Name
(7) U. S.

3. Interface: The P95 shall have the following Electrical and Physical Interfaces.

a. Electrical:

(1) The P95 shall interface with the P91 in accordance with Drawing 25354-102.
(2) The P95 shall interface with the P94 in accordance with Drawing 25354-102.
(3) The P95 shall interface with the P92 in accordance with Drawing 25354-102.
(4) The P95 shall interface with the Third Stage Motor in accordance with Drawing 25354-102.

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

b. Physical:

(1) The P95 shall interface with the P91 in accordance with Drawing NA5-15866.

(2) The P95 shall interface with the P94 in accordance with Drawing NA5-15866.

(3) The P95 shall interface with the P92 in accordance with Drawing NA5-15866.

(4) The P95 shall interface with the Third Stage Motor in accordance with ICD 25-15403.

(5) The P95 shall interface with the Third Stage Motor in accordance with Drawing NA5-15866.

4. Environmental: The (P95) design shall implement proven physical to meet the following environmental requirements.

a. The (P95) shall be capable of operating satisfactorily (checkout of in-flight) during exposure to a natural combination of the operative and after exposure to a natural combination of the non operative environments specified in the Technical Requirements.

b. The electro-interference characteristics of the (P95) shall be in accordance with the applicable paragraphs of AF/BSD Exhibit 62-87.

5. Weapons Effects: The (P95) shall be designed to withstand the applicable weapons effects environments called out in AF/BSD Exhibit 62-83.

6. Monitoring: Not applicable.

7. Operating Life: The (P95) shall be capable of operating in the readiness condition for a period of at least three years without encountering wear-out, out of tolerance characteristics, drifts, or similar problems.

8. Safety Considerations: The (P95) shall be constructed to provide the greatest possible maximum safety to personnel while installing, operating, and maintaining it.

9. Special Considerations: None

II. RECOMMENDED SOLUTION (Cont'd)

C. OPERABILITY AND MAINTAINABILITY

The P95 shall be constructed to minimize the skill, experience, and time necessary for its assembly, operation, maintenance and repair.

The P95 shall be constructed so that all assemblies, connectors, and interconnections are accessible for checking, adjustment, maintenance, and repair, with a minimum of disturbance to other parts and with a minimum quantity and variety of special tools.

D. RELIABILITY

Minuteman standard parts and proven design practices shall be utilized to insure that the requirements of paragraph D after Technical Requirements are met.

E. APPLICABLE DOCUMENTS

The same as specified in the Technical Requirements.

FIGURE A NUMBER 6274
SHEET 8 OF 8

TYPE OF LIST A: AEROSPACE VEHICLE EQUIPMENT	MODEL DESIGNATION B: SM-80 WEAPON SYSTEM	SUB SYSTEM IDENTIFICATION C: NS-17	CONTRACTOR D: Autonetics, A Division of North American Aviation, Inc.
FIGURE A NUMBER E: 6275	MILITARY NOMENCLATURE AND FED. MFR'S CODE F: 94756	COMMON NOMENCLATURE G: MISSILE GUIDANCE SET (NS17A)	H ORIGINATION DATE: 12/8/62; J AFBSD APP DATE: 3-11-63; CONTRACT NO. K: AF04(694)-247

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
4-1-63	6A			N/A			65787-101										$440,000					69 wk	W-6	

I. TECHNICAL REQUIREMENTS

A requirement exists for a means which must be located within the WS133B Missile between the third stage engine and the Re-entry Vehicle (R/V) to accomplish the following functions. These functions are detailed under Functional Requirements.

a. Stabilize, navigate and steer the missile throughout the three stages of powered flight in accordance with Guidance and Control equations to be mutually agreed upon between BSD/STL and the Contractor with an accuracy budget which is in accordance with the requirements of AF/BSD 62-58.
AF/BSD 62-58 par. 4. 1. 1. a par. 3. 3

b. Provide discrete commands to other missile subsystems as required for staging ignition, Stage III Thrust Termination, R/V prearming, and Stage III dispersal as specified by AF/BSD 62-58 and as modified by the Contractor as a result of preliminary design and functional analysis.
AF/BSD 62-58 par. 4. 1. 1. b par. 4. 2. 4. 5

c. Maintain guidance system alignment in level throughout the prelaunch phase.
AF/BSD 62-58 par. 4. 1. 1. c

d. Maintain guidance system alignment in azimuth before and following ground shock or loss of the ground based-azimuth reference (collimator light beam) alignment shall be maintained for an indefinite period.
AF/BSD 62-58 par. 4. 1. 1. d par. 3. 6. 2

* The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

	REMARKS
I. TECHNICAL REQUIREMENTS (Continued)	
e. Process and execute commands received from ground el-ctr- -- system	AF/BSD 62-58 par. 4.1.1.6
f. Conduct self tests and report status to the Launch Control Facility (LCF) in response to commands from the LCF.	[illegible]
g. Transmit internal loads and R/V loads to the Stage III Engine.	
h. Provide protection to internal equipment from thermal and other environments.	
i. Perform periodic self calibration and bias adjustments.	
The NS17A (Fig A #6275) Missile Guidance Set is required to consist of the following airborne equipments, which are to function in the manner described in the referenced paragraphs of AF/BSD 62-58.	AF/BSD 62-58
Inertial Measurement Unit (IMU) Gimbal System consisting of Stable Element, Middle and Outer Gimbals and Support Structure Stabilization Gyros (Autonetics G6B4 free-rotor type) Velocity Meters (M.I.T. 16 PIGA Type) Level Sensors Azimuth Alignment Device Secondary Azimuth Reference Unit (SARU) Calibration Unit Digital Readout Angle Transducer Associated Secondary Power Supplies and Control Electronics	Par. 1.2.1 (a) Par. 4.1.2 (a) Par. 4.2.2
Digital Computer Unit (DCU)	Par. 1.2.1 (b) Par. 4.2.3
Control and Discrete Unit	
Guidance and Control Compartment Structure (Guidance Body Section)	Par. 1.2.1 (c) Par. 4.2.8
A. FUNCTIONAL REQUIREMENTS	Detail Flow Diagram and Forms B Reference
The functional performance of the NS17 (Fig A #6275) in blocks 1 and 2 require that a compute program be contained in the NS17 Computer Memory. The Automatic program requirements of blocks 1.0 and 2.0 are contained in the operational Ground & Flight Tape.	AF/BSD 62-58 1.0 2.0
Perform Flight Mission Functions (Block 1.0)	
Stabilize, Navigate and Steering Functions	
Navigation functions (Block 1.30) which are performed by the NS17 (Fig A #6275) continuously throughout powered flights from lift-off to thrust termination shall be:	
Provide earth fixed stable reference (i.e. by use of stable platform)	1.30.1

FIGURE A NUMBER 6275
SHEET 2 OF 45

I. TECHNICAL REQUIREMENTS (Continued)

A. FUNCTIONAL REQUIREMENTS (Continued)

	Detail Flow Diagram and Forms B Reference
Sense acceleration (i.e. by use of PIGA's)	1.30.2
Compute thrust velocity in computer coordinates (i.e., by operating mathematically on PIGA output)	1.30.4
Compute gravity and centripetal corrections (i.e. by appropriate mathematical calculations)	1.30.5
Compute coriolis correction (i.e., by solving coriolis equation)	1.30.8
Compute true velocity components (i.e., by correcting thrust velocity mathematically)	1.30.9
Integrate velocity to get position	1.30.11
Compute gyro compensation (i.e., by solving gyro compensation equation)	1.30.13
Compute instrument velocity compensation as function of acceleration (i.e., by computing PIGA compensation)	1.30.14
Extrapolate position to next cycle (i.e., mathematical first order extrapolation)	1.30.15
Provide time base	1.30.16

Block 1.30 provides inflight missile position, attitude and velocity data used by the D37B (Part of Fig A #6275) Computer in conjunction with the stored flight program to generate steering commands used during powered flight, flight safety checking and issuance of ordnance discretes.

Steering and control functions during first stage flight are identified by Block 1.2. These functions include the generation of the steering commands, flight control calculations for the P89 Stage I NCU (Fig A #6261) and issuance of ordnance discrete commands:

Steering Command Generation Functions (Stage I Flight)

Provide required constants for Stage I equations (i.e., furnished or generated by Flight Program)	1.2.39
Provide programmed Stage I equations (i.e., furnished by Flight Program)	1.2.40
Hold initial roll attitude to clear obstructions	1.2.8
Hold zero pitch command angle (vertical rise)	1.2.1
Hold zero yaw command angle (vertical rise)	1.2.6

FIGURE A NUMBER 6275
SHEET 3 OF 45

I. TECHNICAL REQUIREMENTS (Continued)

A. FUNCTIONAL REQUIREMENTS (Continued)

	Detail Flow Diagram and Forms B Reference
Determine time to initiate roll out (i.e., furnished by Flight Program).	1.2.11
Generate roll command angle for roll out (i.e., furnished by Flight Program. Angle is target dependent).	1.2.9
Determine time to initiate pitch over (i.e., when vertical velocity reaches programmed value after roll out is completed).	1.2.12
Compute pitch trajectory command angle (pitch-over to pre-staging) (i.e., as function of V_x, V_z).	1.2.3
Flare pitch command as required (i.e., to avoid step function changes in pitch).	1.2.2
Hold zero roll command angle (pitch over to staging).	1.2.10
Generate yaw command angle (pitchover to staging) (i.e., flight programmed function. Command angle is function of V_y and Y).	1.2.7
Generate pitch command angle (pitchover to prestaging) (i.e., programmed function of V_x, V_z).	1.2.4
Determine time to initiate prestaging (i.e., when thrust was decreased to a predetermined fraction of maximum value).	1.2.13
Generate constant rate pitch command angle (prestaging to staging).	1.2.5
Flight Control System Computation Functions (Stage I Flight)	
Compare pitch command with pitch attitude.	1.2.14
Apply gain and limiting to pitch error.	1.2.15
Combine pitch error command with compensated pitch body rate.	1.2.16
Apply pitch loop equalization and apply gains.	1.2.17
Limit pitch nozzle command.	1.2.18
Compare yaw command with yaw attitude.	1.2.19
Apply gain and limiting to yaw error.	1.2.20
Combine yaw error command with compensated yaw body rate.	1.2.21

FIGURE A NUMBER 6275
SHEET 4 OF 45

	Detail Flow Diagram and Forms B Reference
I. TECHNICAL REQUIREMENTS (Continued)	
A. FUNCTIONAL REQUIREMENTS (Continued)	
Apply yaw loop equalization and apply gain	1.2.22
Limit yaw nozzle command	1.2.23
Compare roll command with roll attitude	1.2.24
Apply gain and limiting to roll error	1.2.25
Combine roll error command with compensated roll body rate	1.2.28
Apply roll loop equalization and gain	1.2.29
Limit roll nozzle command	1.2.30
Differentiate roll angle	1.2.26
Apply gain and equalization to roll rate	1.2.27
Change control system gain as required	1.2.33
Provide instrument drift compensation (i.e. for angular accelerometer outputs)	1.2.35
Apply gain to pitch rate	1.2.36
Apply gain to yaw rate	1.2.37
Form sum and difference terms for yaw, pitch and roll moments to generate nozzle commands	1.2.31
Discrete Commands (Stage I Flight)	
Determine time to initiate I - II staging (i.e. when thrust has decreased to a predetermined fraction of maximum value)	1.2.38
Initiate I - II staging ordnance	1.3
Steering and control functions during second stage flight are identified by Block 1.7. These functions include the generation of the steering commands, and flight control calculations for the P90 Stage II TVCU (Fig A #6262).	
Command Generation Functions (Stage II Flight)	
Provide programmed constants for Stage II equations (i.e. furnished or generated by Flight Program)	1.7.41
Provide programmed Stage II equations (i.e. furnished by Flight Program)	1.7.42

FIGURE A NUMBER 6275
SHEET 5 OF 45

	Detail Flow Diagram and Forms B Reference
I. **TECHNICAL REQUIREMENTS** (Continued)	
A. **FUNCTIONAL REQUIREMENTS** (Continued)	
Compute pitch trajectory command angle (staging to prestaging) (i.e. programmed function of V_x, V_z)	1.7.1
Flare pitch command as required (i.e. to avoid step function changes in pitch)	1.7.2
Generate pitch command angle (staging to prestaging) (i.e. combined pitch command and flare command)	1.7.3
Generate constant rate pitch command angle (prestaging to staging)	1.7.4
Generate yaw command angle (staging to staging) (i.e. flight programmed function. Angle is function of V_y and T)	1.7.5
Generate zero roll command (staging to staging) (i.e. further missile roll must be avoided after initial roll-out)	1.7.6
Flight Control System Computation Functions (Stage II Flight)	
Provide instrument drift compensations (i.e. for angular accelerometer outputs)	1.7.11
Apply gain to yaw rate	1.7.12
Apply gain to pitch rate	1.7.13
Compare pitch command with pitch attitude	1.7.14
Apply gain and limiting to pitch error	1.7.15
Combine pitch error command with compensated pitch body rate	1.7.16
Apply pitch loop equalization and gains	1.7.17
Limit pitch injector pintle command	1.7.18
Compare yaw command with yaw attitude	1.7.19
Apply gain and limiting to yaw error	1.7.20
Combine yaw error command with compensated yaw body rate	1.7.21
Apply yaw loop equalizations and gains	1.7.22
Limit yaw injector pintle command	1.7.23
Program injectant fluid flow	1.7.24

FIGURE A NUMBER 6275
SHEET 6 OF 45

	Detail Flow Diagram and Forms B Reference
I. TECHNICAL REQUIREMENTS (Continued)	
A. FUNCTIONAL REQUIREMENTS (Continued)	
Measure injectant fluid flow	1.7.25
Compare measured injectant fluid flow with programmed fluid flow	1.7.26
Limit fluid dump command	1.7.27
Generate position command for four pintle injection valves to develop side thrust from fixed nozzle	1.7.28
Compare roll command with roll attitude	1.7.30
Apply gain and limiting to roll error	1.7.31
Differentiate roll angle	1.7.32
Apply gain and equalization	1.7.33
Compare roll error command with compensated roll body rate	1.7.34
Apply roll loop gain	1.7.35
Limit roll valve command	1.7.36
Generate valve position command for fixed side thrust nozzle	1.7.37
Change control system gains as required	1.7.39
Discrete Commands (Stage II Flight)	
Determine time to initiate prestaging	1.7.9
Determine time to initiate staging	1.7.40
Initiate II - III staging ordnance and initiate stage III skirt removal	1.9 1.12.32
Steering and control functions during third stage flight through thrust termination are identified by Block 1.12. These functions include generation of the steering commands, and flight control calculations for the P91 Stage II NCU (Fig A #6263) shall be:	
Command Generation Functions (Stage III Flight)	
Provide required constants for third stage equations (i.e. furnished or generated by Flight Program)	1.12.34
Provide programmed third stage equations (i.e. furnished by Flight Program)	1.12.35

FIGURE A NUMBER 6273
SHEET 7 OF 45

I. TECHNICAL REQUIREMENTS (Continued)

A. FUNCTIONAL REQUIREMENTS (Continued)

	Detail Flow Diagram and Forms B Reference
Compute pitch command angle (i. e. programmed function of V_x, V_z)	1.12.1
Flare pitch command as required (i. e. to avoid step function changes in pitch)	1.12.2
Generate pitch command angle (i. e. combined pitch command and flare pitch command)	1.12.3
Compute yaw command angle (i. e. flight programmed function. Angle is function of V_y and z)	1.12.5
Generate zero roll command (i. e. further missile roll must be avoided after initial roll-out)	1.12.7
Flight Control System Computation Functions (Stage III Flight)	
Compare pitch command with pitch attitude	1.12.8
Apply gain and limiting to pitch error	1.12.9
Differentiate pitch platform angle	1.12.10
Apply gain and equalization to pitch platform rate	1.12.11
Combine pitch error command with compensated pitch platform rate	1.12.12
Apply pitch loop gain and equalization	1.12.13
Limit pitch nozzle commands	1.12.14
Compare yaw command with yaw attitude	1.12.15
Apply gain and limiting to yaw error	1.12.16
Differentiate yaw platform angle	1.12.17
Apply gain and equalization to compensated yaw platform rate	1.12.18
Combine yaw error command with compensated yaw platform rate	1.12.19
Apply yaw loop gain and equalization	1.12.20
Limit yaw nozzle commands	1.12.21
Compare roll command with roll attitude	1.12.22

FIGURE A NUMBER 6275
SHEET 8 OF 45

I. TECHNICAL REQUIREMENTS (Continued)	Detail Flow Diagram and Forms B Reference
A. FUNCTIONAL REQUIREMENTS (Continued)	
Apply gain and limiting to roll error	1.12.23
Differentiate roll platform angle	1.12.24
Apply gain and equalization to roll rate	1.12.25
Combine roll error command with compensated roll platform rate	1.12.33
Apply roll loop gain	1.12.26
Limit roll nozzle commands	1.12.27
Generate position commands for 4 nozzles	1.12.28
Change system gains as required	1.12.30
Ordnance Discrete Command (Stage III Flight)	
Compute time for R/V mechanical disconnect (i.e. when velocity to be gained meets programmed condition)	1.15.1
Issue mechanical R/V disconnect command	1.16
Enter fine countdown and correct velocity to be gained (V_{gx}) as necessary	1.17
Issue thrust termination command (i.e. when velocity to be gained meets programmed condition)	1.18
Flight Safety Checking and Prearm Sequence	
These functions are included in Blocks 1.20, 1.21, 1.22, 1.23, 1.24 and 1.26. Flight safety checking shall be performed to minimize the probability that a warhead detonates outside the prescribed target area. The flight safety checks will begin during the terminal phase of powered flight and be completed after thrust termination but prior to electrical separation of the R/V from the missile third stage. Fulfillment of flight safety requirements impose the following demands on the missile guidance set.	AF/BSD 62-56 par. 5.4
(1) Flight safety criteria must be contained in memory.	
(2) Sample values of flight safety parameter measurements must be compared with the stored criteria to determine if the parameters are in limits.	
(3) Time limits must be established for completion of the flight safety check.	

FIGURE 4 NUMBER 6275
SHEET 9 OF 45

I. TECHNICAL REQUIREMENTS (Continued)

A. FUNCTIONAL REQUIREMENTS (Continued)

(4) A decision must be provided, based on flight safety information, to abort the flight or to prearm the warhead.

The detailed steps involved in the performance of the flight safety checks and in the prearm of the R/V shall be as follows:

	Detail Flow Diagram and Forms B Reference
Establish flight safety parameter limits	
Establish target-dependent flight time (i.e. provided by or generated by Flight Program)	1.20.2
Establish target-dependent yaw limit (i.e. provided by Flight Program)	1.20.6
Establish target-dependent pitch limit (i.e. provided by Flight Program)	1.20.10
Establish time limit for thrust termination discrete prediction (i.e. after entering fine countdown)	1.20.16
Establish time limit for issuance of "Establish R/V prearm status (PA #2), (provided by Flight Program after flight safety checks are satisfactory)	1.23.1
Establish time limit for sensing thrust reversal (i.e. provided by Flight Program)	1.23.6
Establish time to perform computer self check (i.e. provided by Flight Program)	1.20.19
Monitor or measure flight safety parameters	
Measure flight time during fine countdown	1.20.1
Measure vehicle yaw at T_2 (i.e. T_2 = programmed time)	1.20.5
Measure vehicle pitch at T_3 (i.e. T_3 = programmed time)	1.20.9
Monitor mechanical disconnect	1.20.13
Monitor Establish R/V prearm status	1.23.2
Monitor sense thrust reversal	1.23.5
Flight safety computations	
Compare flight time limit with measured flight time	1.20.3
Compare yaw limit with measured vehicle yaw	1.20.7

FIGURE A NUMBER 6275
SHEET 10 OF 45

REV SYM B

TECHNICAL REQUIREMENTS (Continued)

FUNCTIONAL REQUIREMENTS (Continued)

Compare pitch limits with measured vehicle pitch

Predict time to thrust termination discrete (i.e., determined as a function of velocity and altitude)

Compare status of prediction with time limit for prediction (i.e., thrust termination

Compare pre-arm status with time limit for pre-arm status

Compare time to thrust reversal with time limit for thrust reversal

Issuance of Discretes, Stage III (Cont)

Issue pre-arm R/V (P, A, F-)

Issue establish R/V pre-arm status (P, A, F)

Establish R/V pre-arm status

Abort

Separate R/V electrical connection

Other Requirements of Flight Safety Checks

Store flight time (F/T) status in flight safety memory

Store yaw status in flight safety memory

Store pitch status in flight safety memory

Store mechanical disconnect (M/D) status in flight safety memory

Check flight safety memory

Sense thrust reversal

Provide time delay

I. TECHNICAL REQUIREMENTS (Continued)

A. FUNCTIONAL REQUIREMENTS (Continued)

Other Requirements of Block 1

A requirement exists for a means located in the NS17 (Fig A #6275) to provide interfacing functions to the NCU's and ordnances devices. Specifically:

1. A requirement exists for the capability of providing nozzle or pintle valve position command compensation, summing of nozzle or pintle valve position feedback and compensated position, command signal, and amplification of that error signal for control of the First and Third Stage NCU's and the Second Stage TVCU.
2. A requirement exists for the capability of switching the control and discrete unit output and downstage feedback input into the first stage NCU, second stage TVCU or third stage NCU as a function of the 3 stage select discretes issued by the computer.
3. A requirement exists for providing all downstage pickoff feedbacks to the computer for the periodic and preflight missile checkout.
4. A requirement exists for providing power amplification to the missile ordnance discretes.
5. A requirement exists for providing computer monitoring of missile ordnance discretes.

Maintain Readiness, Monitor and Launch (Block 2 of Master Operational W/S Analysis Functional Flow Diagram)

1. Maintain guidance system alignment in level throughout the prelaunch phase.
   a. Sense platform tilt from the Selected two-axis level sensor.
   b. Null platform tilt by processing the stabilization gyros.

Detail Flow Diagram and Forms B Reference

1.2.14	1.2.15
1.2.16	1.2.19
1.2.20	1.2.21
1.2.24	1.2.25
1.2.26	1.3
1.7.14	1.7.15
1.7.16	1.7.19
1.7.20	1.7.21
1.7.30	1.7.31
1.7.34	1.9
1.12.8	1.12.9
1.12.12	1.12.15
1.12.16	1.12.19
1.12.22	1.12.23
1.12.33	1.17.3
1.16	1.23.8

Remarks

AF BSD 62-58
par. 4.1.1.c
2.71.2.2.c(1)

2.71.2.2.c(1)

I. TECHNICAL REQUIREMENTS (Continued)

A. FUNCTIONAL REQUIREMENTS (Continued)

Requirement	Remarks
2. Maintain guidance system alignment in azimuth. Alignment shall be maintained before and following ground shock or loss of the primary azimuth reference.	AF BSD 62-58 Par. 4.1.1.d Par. 3.6.2 Detail Flow Diagram and Forms B Reference 2.71.2 2.71.4 2.71.5 2.71.6 2.72.1 2.72.2 2.72.3
a. Provide primary azimuth reference.	2.71.2.2.c(3)
b. Senses azimuth misalignment with respect to primary reference.	2.71.2.2.c(3)
c. Adjust platform azimuth with respect to primary reference.	2.71.2.2.c(3)
d. Update azimuth gyro bias.	2.71.2.2.c(7)
e. Provide secondary azimuth reference.	2.71.2.2.c(3)
f. Calibrate secondary azimuth with respect to primary reference.	2.71.2.2.c(4)
g. Sense loss of primary reference (and switch to SARU).	2.71.2.2.c(3)
h. Determine azimuth misalignment with respect to secondary reference.	2.71.2.2.c(2)
i. Adjust platform asimuth with respect to secondary reference.	2.71.2.2.c(2)
j. Update asimuth gyro bias.	2.71.2.2.c(7)
3. Process and execute commands received from ground electronics system.	AF BSD 62-58 Par. 4.1.1.e Par. 4.2.7
a. Execute commands for the LCF and LF.	
(1) Execute strategic alert command.	2.65
(2) Execute strategic standby command.	2.66

	Detail Flow Diagram and Forms B Reference
I. TECHNICAL REQUIREMENTS (Continued)	
A. FUNCTIONAL REQUIREMENTS (Continued)	
3. (Continued)	
a. (Continued)	
(3) Execute inhibit launch command	2.70
(4) Execute launch command	
(5) Execute preparatory launch.	2.68
(6) Operational status interrogation command	
(7) Maintenance status interrogation command	
(8) Target verification interrogation command	Remarks
b. Control self tests and report status to the LCF in response to commands from the LCF.	AF/BSD 62-58 Par. 4.1.1.f
(1) Process status	
(2) Execute missile calibration test command	2.61
(3) Execute ground systems test command	2.62
(4) Execute missile dynamic test command	2.64
(5) Perform automatic ground program	2.71
c. Monitor and control LF Status, and control all LF sequences as required.	
(1) Monitor inner security status	2.25
(2) Monitor outer security status	2.26
(3) Monitor AVE	2.27
(4) Monitor OGE	2.28
(5) Monitor RPIE	2.29
(6) Monitor Launch Enable System (LES)	
(7) Execute launch sequence when commanded	2.72

FIGURE A NUMBER 6275
SHEET 14 OF 45

I. TECHNICAL REQUIREMENTS — N517-10 / AF BSD 62-58

B. DESIGN CONSTRAINTS

1. Power - During ground operation, the G and C set shall be capable of operating from a 28 ± 1 volt dc source. During startup of the IMU gyros a dc voltage lying between 39.5 volts and 44.5 volts may be applied to the spin motors for up to 2 seconds. — Para 4.2.1.4

During airborne operations the N517 shall be capable of operation from the airborne - battery having a terminal voltage of 28 ± 1.5 volts. — Para 4.2.1.4

2. Physical - The missile guidance set shall be compatible with the following truncated cone dimensions. — Para 4.2.1.3

Length	31.5 inches
Diameter (aft)	37.5 inches
Diameter (forward)	32.5 inches

The missile guidance set (including IMU, DCU, (Parts of Fig A # 6275), third stage battery SE13G (Fig. A # 6210) Compartment Structure and wiring) shall not exceed the following maximum weight.: 235 lbs. — Para 4.2.1.2

3. Interfaces - The missile guidance set shall interface electrically with the P95 Cable Assembly, (Fig A # 6274) and the G&C umbilical. These cables together with the P93 & P94 Cable Assemblies. (Fig A # 6272 & 6273) are used to transmit signals to and from the following equipment.

P68 Angular Accelerometer (Fig A # 6202)
P89 Stage I Nozzle Control Unit (Fig A # 6261)
P90 Stage II Thrust Vector Control Unit (Fig A # 6262)
P91 Stage III Nozzle Control Unit (Fig A # 6263)
SE13G Airborne Battery (Fig A # 6210)
Ordnance Devices (squibs)
Staging & engine ignition
Thrust termination
R/V separation
Stage III Dispersal ordnance
Penetration aids.
D43 Electromechanical Decoder (Fig A # 6250)
C21Q Collimator Set (Fig A # 602)
C225 G&C Power Conversion Equipment (Fig A # 13002)
C163 Signal Data Converter (Fig A # 13000)

The missile guidance set interfaces mechanically with the
R/V
Third stage missile body structure
SE13G airborne battery (internal interface) (Fig A # 6210)
Guidance and Control umbilical

I. **TECHNICAL REQUIREMENTS** (Continued)

NS17-11

B. **DESIGN CONSTRAINTS** (Continued)

4. **Environmental** -

a. The device shall becapable of withstanding operating and non-operating environmental conditions as specified in AFBSD Exhibit 62-51 and its applicable document with the exceptions listed in the supplement.

b. The device shall have as its design objective the applicable electro - interface requirements set forth in AFBSD Exhibit 62-87, subject to the exceptions listed in the supplement.

5. **Weapons Effects** - This device shall conform to the applicable paragraphs as set forth in AFBSD Exhibit 62-83 subject to the exceptions listed in the supplement.

6. **Monitoring** - (As required by paragraph 4.1.3.4 of AF/BSD 62-58)

During ground operations the NS17, under program control, shall be capable of being monitored or described in the listed detail blocks of Block 2: Maintain Readiness Monitor and Launch — AFBSD 62-58 Para 4.1.3.4

Monitor A/B ordnance status	2.27.1
Monitor Reentry vehicle status	2.27.2
Monitor A/B G&C status	2.27.3
Monitor Guidance & Control environmental subsystem status	2.27.3.1
Monitor Guidance & Control subsystem power shutdown	2.27.3.2
Monitor Guidance & Control subsystem operational status	2.27.3.3
Monitor GES status	2.28.1
Monitor Message Processing and Control System status	2.28.1.1
Monitor launch enable system status	2.28.1.2
Monitor launch facility, security system status	2.28.1.3
Monitor Communications network system status	2.28.1.4
Monitor launch facility environmental status	2.28.2
Monitor launch facility ordnance safety	2.28.3
Monitor A/N OGE status	2.28.4
Monitor Power conversion status	2.28.4.1
Detect signal convertor status	2.28.4.2
Monitor autocollimator	2.26.4.3
[illegible]	2.28.5

7. **Operating Life** - The operating life of the NS17 (Fig A # 6275) shall meet the requirements of AFBSD Exhibits 62-123 and 62-58. It shall be capable of operating for a minimum of 3 years within a missile emplaced in its silo environment with the missile predominately in either the Strategic Alert, Strategic Standby Mode.

8. **Safety Consideration** - The NS17 (Fig A # 6275) shall be designed so that the probability of guidance system or decoder failure which could cause inadvertent launch will be less than the probability specified in AFBSD 62-58. The NS17 (Fig A # 6275) shall conform to the requirements of AF/BSD 62-82 Weapons System Safety Criterion, Maintenance. — AFBSD 62-58 Para 4.2.7.2.6

THIS
PAGE
IS
MISSING
IN
ORIGINAL
DOCUMENT

I. TECHNICAL REQUIREMENTS (Continued)

E. APPLICABLE DOCUMENTS (Continued)

AFBSD Exhibit 62-87 dated 15 June 1962, titled Electro-Interference Control Requirements for Minuteman (WS 133B):

Paragraph 2.1, 3.1.1, 4.3.3, 4.3.4.1.3

AFBSD Exhibit 62-89 dated June 1, 1962, titled: Preservation, Packaging and Packing Criteria /WS 133B.

II. RECOMMENDED SOLUTION

It is recommended that equipment described below, designated as the NS17 Missile Guidance Set (Fig A # 6275), be designed and fabricated to fulfill the above technical requirements.

A. FUNCTIONAL DESCRIPTION

The NS17 (Fig A # 6275) shall implement the functional requirements stated on Part IA of this document. In the WS 133B weapons system functional flow diagram, these functions are contained in Block 1 (Perform Flight Mission) and Block 2, (Maintain readiness monitor and Launch).

The detail manner in which the NS17 (Fig A # 6275) performs these functions is determined by the Automatic Ground Program for block 2 and the Flight Program for block 1.

The implementation of these functional requirements will be accomplished by incorporating the following features into the NS17 (Fig A # 6275).

1. The NS17 (Fig A # 6275) will be capable of accepting and executing the commands of the operational flight Tape Program. This flight tape will contain navigation, steering and stabilization equations. The tape will also generate discrete commands for other missile subsystems. These commands will include staging, ignition, and RV pre-arming. The tape will also include flight safety checks.

2. The NS17 (Fig A # 6275) will be capable of accepting and executing the commands of the Automatic Ground Program. This program will contain calibration, test, monitor, and launch commands. The program will also provide for processing missile status.

The functional description of the major subsections of the NS17 (Fig A # 6275) is as follows:

Subsystem Schematic Block Diagram 85195-306

a. Inertial Measuring Unit. (IMU) - The IMU is an electromechanical system which will maintain in the flight environment, a physical reference or platform, whose inertial orientation is known precisely. This platform defines an earth fixed coordinate system whereby earth's position of the system is computed from the systems initial position and the missile motion which is detected by inertial instruments of the IMU. The inertial instruments sense the motion of the missile and the D37 Computer (DCU) computes the required forces and torques required to constrain the orientation of the platform to earth fixed coordinates. In a manner compatible to the DCU mechanization and missile motion, torquer motors working together with platform servos and gimbals, perform the mechanical reactions required to maintain the

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

a. Inertial Measuring Unit. (IMU) (Continued)

platform as an inertial reference, around which the missile orientates itself to find a realizable target trajectory. The IMU in conjunction with the DCU provides the kinematic data from which all missile commands are generated.

A detailed description of the IMU subsystem is as follows.

1. Gimbal System - The IMU Gimbal system consists of the stable element, middle and outer gimbals and support structure. This structure provides the means for mounting the accelerometers, gyros and gyrocompass optical alinement block. Gimbal position resolvers are provided between the stabilized platform and the missile frame to read out gimbal attitudes. These attitudes are used for rate and position control in the Flight Control Program. Attitudes are converted to electrical signals by the gimbal position control converters. These signals are used by the computers.

2. Stabilization Gyros - The IMU stabilization gyros will be two (2) Autonetics G6 B4 two axis gyros. Three axes of the two (2) G6B4 gyros form the platform reference axes. The fourth axis is slaved to the X axis of the controlling gyro by means of a caging amplifier. In order to provide a means for accurately torquing and correcting for inherent drifts and "g" sensitive drifts of the gyros, a gyro torque signal data converter has been provided which will convert commands from the computer into precision amplitude current pulses. The stabilization of the platform by the gyro motors is accomplished by means of three platform electronic control amplifiers and their corresponding preamplifiers. Discrete signals are provided to switch voltages out of the digital computer into the control points of the control amplifiers for slewing and testing. These discrete signals are supplied to the gyro torquing through a tuning network which tune the inductive reactance of the gyro coil, presenting a pure resistive load to the gyro torque converter.

3. Velocity Meters (MIT PIGA Type) - The IMU accelerometers will be three type 16 PIGA's. The sensitive axis of the PIGA's form the velocity reference axis of the stable platform, and provide error signals to the PIGA Controllers. The Controllers amplifier, compensate, and provide power for driving the PIGA servo motors. The PIGA Electronic switch provides a means for Computer Control of the PIGA for servo tests and the disable discrete. The angular velocity of each pendulous integrating gyro (PIG) is converted into uniform electrical signals by the PIGA Controllers. The DCU interpretate these pulses to obtain position and velocity information.

4. Level Sensors - Four level detectors are mounted on the stable platform alinement unit to provide level information during several orientations of the platform. Suppressed carrier outputs of a balanced bridge consisting of the level sensing device and balance impedances, are amplified, demodulated, filtered and shaped for input to the DCU This DCU interpretates these outputs as platform tilts and torque the platform to level. The level sensor output is a two state signal and the leveling torques are always in a limit cycle.

N817-14

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

a. Inertial Measuring Unit. (IMU) (Continued)

5. Azimuth Alinement Device - The azimuth alinement device consists of a loop involving a platform mounted mirror and silo mounted collimator (Fig A # 602). Digital outputs of the collimator are relayed into the computer through the C163 signal converter (Fig A # 13000). Both the collimator (Fig A # 602) and the C163 (Fig A # 13000) are ground equipment items. The computer interprets the digital output of the signal converter as platform azimuth misalinement in bidirectional states and adjusts the platform by torquing it in azimuth. The output of the signal converter is a two state signal.

6. Secondary Azimuth Reference Unit (SARU) - When the primary reference is unreliable as determined by the DCU, secondary azimuth reference is provided by the SARU. The platform maintains its azimuth alinement within the limits of the G64B gyro drift. When the secondary azimuth reference is in control, an angular deviation of the gyro float from a null position relative to its case will cause a pickoff voltage. This voltage will be routed from the auxiliary gyro platform to a preamplifier mounted on the stable platform. Here, the auxiliary gyro signal will be amplified and sent to the electronics assembly where it will be further amplified, compensated, and power amplified in the auxiliary gyro caging amplifier. The output of the caging amplifier will be routed back to the auxiliary gyro platform to drive the gyro torquer.

The gyro is oriented with its input axis E-W and the pickoff is caged by the use of the caging amplifier. The measure of this caging current is representative of the off E-W alignment of the gyro input axis. The caging current is measured by the computer after analog-to-digital conversion, and appropriate averaging.

The gyro is reversed for bias determinations by use of the electronic control amplifier and computer command signals. While an azimuth determination is being made the electronic control amplifier slaves the gyro, through the torquer motor, to a null on the Optical Angle Resolver.

7. Digital Readout Angle Transducer - The optical angle readout consists of a photocell and light beam coupling which is interrupted by a coded disk. These interruptions are interpreted by the computer as rotations of the auxiliary gyro platform.

Relative angular motion of the auxiliary gyro platformffrom a desired null of the Optical Angular Resolver will cause a voltage to be present at the Optical Angular Resolver output. This signal will be preamplified on the stable platform. The output of the preamplifier is the input to the auxiliary platform control amplifier located in the electronics assembly. Here the signal is amplified, compensated, and further power amplified. The output of this amplifier is returned to the stable platform where it drives the auxiliary platform motor with such a polarity that it returns the auxiliary platform to a null. Four other inputs to the auxiliary platform control amplifier allow opening, testing 6f the auxiliary platform loop, and slewing the auxiliary platform upon computer command.

8. Loose Equipment - Each IMU will be supplied with a decal and an addendum tape.

NS17-15

REV SYM

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

b. Digital Computer D37B (DCU) (Part of Fig. A #6275)

General Description

Type

The D37B Computer is a serial general purpose digital computer operating in the binary number system. Internal memory storage is accomplished through the use of a dual-sided rotating magnetic disk.

The D37B Computer is a microminiaturized digital computer designed for solving real time problems under the adverse conditions encountered in airborne weapon systems. It is able to sample and process input data and produce output signals with sufficient speed and accuracy as required in the inertial guidance and flight control systems of the WS133B Minuteman Ballistic Missile.

The D37B Computer has increased functional capability as well as reduced size and weight compared to the computer used in the WS133A Minuteman Missile. These features have been achieved mainly through the use of microminiaturized components and a dual-sided memory head plate.

Logical mechanization of the D37B Computer applies the use of NAND gating structure (as opposed to AND-OR gating structure used in the WS133A missile). The use of NAND logic essentially provides a gate which can be universally applied to mechanize any logic configuration needed. This logic also makes more efficient use of the inversion and amplification characteristics which are built into the Integrated circuits (IC's) used.

Input-Output Capability

The following is a comprehensive summary of the D37B Computer Input-Output Capability.

Input Section

(1) Program Load

Five character inputs entered from punched tape or control panel keyboard.

(a) Punched tape: Maximum rate of 800 five-bit characters per second.

(b) Control panel: Manual insertion from keyboard.

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

b. Digital Computer D37B (DCU) (Part of Fig. A #6275

Input-Output Capability (Continued)

Input Section (Continued)

(1) Program Load (Continued)

One bit of each character is used for odd parity check and one bit is used to designate that the character is either a number or a command code.

(2) Incremental

(a) Seven 2 - wire ternary
(b) Two 1 - wire binary
(c) One 1 - wire precision time pulse (GES)

(3) Seventy-two on-off type, divided into three sets of 24 signals each. Four signals are wired internally and are not available to the external interface.

(4) Thirty-two analog voltage inputs arranged into four groups of eight inputs. Each group is selected by the setting of the Phase Register. Selection within a group is under program control. Four of the inputs are wired internally and are not available to the external interface.

(5) Communications (GES)

(a) One NRZ cable comminucations
(b) One gated, pulse-type cable communications timing signal

(6) Control

(a) OGE: 5 control inputs; Tc', Mrc, Kh'c, Ewc, and Dd
(b) MGE: :4 control inputs; Ks'k, Kr'k, Tc and Fsc.

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

b. Digital Computer D37B (DCU)(Part of Fig. A #6275)

Input-Output Capability (Continued)

Input Section (Continued)

(7) Channel Select (MGE)

Ten channel display select input lines, the setting of which determine the serial display output transmitted on the Mpxk and Mp'xk lines.

Output Section

(1) Single Character

(a) Four parallel bits plus one parity bit - for typewriter, tape punch or similar equipment.
(b) Two character output timing signals.

(2) Binary Incremental

Four sets of two-wire binary coded outputs used for controlling gyro torque currents. The output states are modified independent of program control at a rate determined by program.

(3) Discrete

Forty-seven discrete on-off type signals divided into two independent groups of 31 and 15 plus 1 which is generated automatically in the absence of three particular discretes.

The outputs from the two independent groups (31 and 15) are governed by the setting of a five-bit register and a four-bit register respectively, which are set under program control.

(4) Phase Register

Four mutually exclusive discretes which are generated in accordance with the configuration of the three-bit phase register.

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

b. Digital Computer D37B (DCU) (Part of Fig. A #6275)

Input-Output Capability (Continued)

Output Section (Continued)

(4) Phase Register (Continued)

The phase register setting is under program control.

(5) Analog Voltage

Four Analog Voltage outputs which are proportional to an eight-bit digital number (including sign). Each output is directed to four different external locations (including telemetry).

These outputs are converted into signals which range between ± 10v dc with an accuracy of ± 1 percent of full scale (20v).

(6) Communications

(a) One NRZ cable status data output
(b) One NRZ radio status data output
(c) One on-off cable status ready signal

(7) Telemetry

(a) Four complementary output signals consisting of computer clock, origin timing, program timing and accumulator.

(b) Two mode indicators consisting of the execution and compute modes.

(c) Two monitor signals indicating computer synchronization and the occurrence of Master Reset.

(d) Four Analog Voltage outputs which monitor the DAC output commands.

(e) Twelve outputs which monitor the levels of the D37B secondary power supplies.

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

b. Digital Computer D37B (DCU) (Part of Fig. A #6275)

Input-Output Capability (Continued)

Output Section (Continued)

(8) Other Monitor

(a) EM Decoder

One sense voltage output to the EM Decoder.

(b) OGE - Operational Ground Equipment

Three signal indicating a parity-verify error and the compute and load modes.

(c) MGE - Maintenance Ground Equipment

(i) Four complementary output signals used for display and control purposes.
(ii) Two mode indicators monitoring the Manual Halt and Program Halt modes respectively.
(iii) Two error indicators which indicate a Parity or Verify Effor respectively.
(iv) Two Program Memory Bank indicators.

Mode of Operation

The Computer operates under the control of an internally stored program entered from tape, control equipment key-board or similar input filling devices. Certain input-output functions of the computer are carried out through logic not under program control. The computer has the ability to search and/or read the next instruction into the instruction register during execution of the current instruction.

Memory Characteristics

Type - The internal memory storage of the computer consists of a rotating magnetic disk driven by a synchronous motor. The disk is supported on both sides by air bearings. The memory contains dual head plates, one on each side of the rotating magnetic disk. Information is recorded in tracks on both sides of the magnetic disk.

II. RECOMMENDED SOLUTION (Continued

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

b. Digital Computer D37B (DCU) (Part of Fig. A #6275) (Continued)

Memory Characteristics (Continued)

Speed - The magnetic disk rotates synchronously with a 3 phase 400 cycle, memory motor power supply at a nominal speed of 6000 rpm.

Speed Stability - The speed stability of the magnetic memory shall be such that the peak variation of the revolution-to-revolution period of the disk shall not exceed 1.0 microseconds under conditions that: (1) The frequency of the memory motor power is 400 ± 0.0033 cps, and (2) The computer and memory are operating in the specified environment.

Capacity - The total working capacity of the magnetic memory is 6966 words of 24 bits each. These are organised as follows:

Cold Storage	52 channels of 128 words each
Hot Storage	2 channels of 128 words each
H Loop	16 words (with intermediate read head)
E Loop	8 words (with intermediate read head)
F Loop	4 words
A Loop	1 word
L Loop	1 word
U Loop	1 word

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

b. Digital Computer D37B (DCU) (Continued)

Capacity (Continued)

C Loop	4 words (with intermediate read head)
V Loop	4 words
R Loop	4 words
G Loop	4 words
N Loop	1 word
W Loop	1 word
I Loop	1 word
Y Loop	4 words

N517-16

Arithmetic Characteristics - Additional tracks are the clock and sector tracks which are used for computer control, each consists of one channel with 128 words.

Number System - The number system used for internal computation is natural binary. The "two's" complement number system is used to represent negative numbers.

Word Length - The word length is 27 bits. The bit positions are designated T_p, T_{24} ... T_1, T_o, and T_x from the most to the least significant bit. Bits T_p, T_o and T_x are not addressable by program.

Word Formats - A word may have one of several formats depending on its use as an instruction, a full number or split numbers. Bits T_p, T_o and T_x are memory spacer bits which, however, are used in internal operation.

Mechanical Description

The entire D37B Computer shall be housed in a single chassis. The computer will consist of three main sections; the memory section, the power supply section, and the logic and input/output section.

The memory section will be at one end, the power supply at the other end, and the logic and input/output section will be in the center of the chassis.

The chassis will have hermetically sealed covers on top, bottom, and at the memory end of the chassis. The sides of the chassis are cold plates for conductive cooling of the component modules and memory unit.

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

2. (Continued)

b. Digital Computer D37B (DCU) (Continued)

Mechanical Description (Continued)

The memory headplates and rotor are removable from the chassis. The memory motor stator remains with the chassis and is interchangeable with other memory sub-system units.

An electromagnetic shield encases the memory disk and headplates.

c. Control and Discrete Unit (P92) (Part of Fig. A #6275

The control and discrete units will function as follows:

General Description - The P92 Control and Discrete Unit (Part of Fig. A #6275) when operating in conjunction with the P89, P90, P91, shall provide the closed loop position servos for positioning the first stage nozzles, the second stage pintle valves, and the third stage nozzles. The P92 shall provide power amplification to the missile ordnance discretes. The P92 shall provide outputs of all downstage feedbacks and monitors to the computer for missile checkout. The P92 shall consist of the following major components; one control amplifier assembly and one discrete amplifier assembly.

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

c. Control and Discrete Unit (P92) (Part of Fig. A #6275) (Continued)

NS17-17

1. Performance - The Control and Discrete Unit (P92) (Part of Fig. A #6275) will have the following characteristics

a. Control Amplifier Assembly Requirements

±20%

(1) Compensation - The compensation will be a 35 radian per second signal lag filter with a ± 20% tolerance.

(2) Forward Gain - The nominal forward gain from input to downstage outputs with zero feedback will be approximately 14 milliamperes/volt for input voltages less than approximately ±0.5 VDC.

(3) Output Saturation Current - The nominal minimum saturation current of the output will be approximately 9 milliamperes or more.

(4) Feedback Gain - The nominal feedback gain from downstage feedback to downstage outputs with zero input command shall be as follows. All feedback voltages will have a source impedance of approximately 2.2 K ohms.

STAGE SELECT MODE	APPROXIMATE GAIN	APPROXIMATE LINEAR GAIN RANGE
First Stage	7 mils/volt	±1.0 volts
Second Stage	11.7 mils/volt	±0.6 volts
Third Stage	7 mils/volt	±1.0 volts

(5) Stage Switching - A true discrete on the proper stage select line will switch the P92 into the proper downstage control mode. A false discrete will open the switch

DISCRETE OUTPUTS (Computer)

True: -12 ± 1 VDC at a maximum current of 5 mils.

False: +6 ± 1 VDC at a maximum current of 5 mils.

(6) Crosstalk - The Crosstalk will be such as not to interfere with the proper operation of the other channels.

(7) Isolation Resistance - The Isolation Resistance for power and signal leads will be as specified in para. 2.1.5 of AFBSD Exhibit 62-75.

(8) Monitoring Outputs - The P92 will provide voltage divider networks to scale down the downstage feedback voltages to approximately 10 volts for maximum value deflections. The P92 will provide the P68 outputs and the second stage roll amplifier monitors to the computer.

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

c. Control and Discrete Unit (P92) (Part of Fig. A #6275) (Continued)

1. Performance (Continued)

b Discrete Amplifier Assembly Requirements - The activation of the discrete amplifier (Gas Generator No. 1 Amplifier, Gas Generator No. 2 Amplifier, I-II Staging Amplifier, II-III Staging Amplifier, Mechanical Disconnect Amplifier, Thrust Termination Amplifier, Penetration Aid #1 Amplifier, Penetration Aid #2 Amplifier, Penetration Aid #3 Amplifier, Prearm Command Amplifier, Electrical Disconnect Command Amplifier, Phase I Retro Command Amplifier, Pitch Rocket Command Amplifier, Phase II Retro Command Amplifier), will comply with the following requirements.

(1) Input Commands - A true state on all of the four input lines (Discrete Input Function, Missile Ordnance Enable, Missile Ordnance Enable Interlock, Ordnance Clock) will place the discrete amplifier in a true state. A false state on any one or combination of the four lines will place the discrete amplifier in a false state. NS17-18

(a) True: -12 ± 1 VDC; 5.0 ma maximum at -11 VDC.

(b) False: +6 ± 1 VDC; 1.5 ma maximum at +5 VDC.

(2) Output to Gas Generator No. 1 Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohm maximum load

(b) False: Less than 100 ma.

(3) Output to Gas Generator No. 2 Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohm maximum load

(b) False: Less than 100 ma.

(4) Output to I-II Staging Ordnance Load (Ignition Stage II and Stage Separation I-II)

(a) True: 18 amps minimum into a 0.25 ohm maximum load

(b) False: Less than 200 ma.

(5) Output to II-III Staging Ordnance Load (Ignition Stage III and Stage Separation II-III)

(a) True: 18 amps minimum into a 0.25 ohms maximum load

(b) False: Less than 200 ma

(6) Output to R/V Mechanical Disconnect Ordnance Load:

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

c. Control and Discrete Unit (P92) (Part of Fig. A #6275) (Continued)

1. Performance (Continued)

b. Discrete Amplifier Assembly Requirements (Continued)

(6) Output to R/V Mechanical Disconnect Ordnance Load: (Continued)

(a) True: 9 amps minimum into a 0.5 ohms maximum load

(b) False: Less than 100 ma

(7) Output to Thrust Termination Ordnance Load:

(a) True: 56 amps minimum into a 0.125 ohms maximum load.

(b) False: Less than 400 ma.

(8) Output to Penetration Aid No. 1 Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohms maximum load

(b) False: Less than 100 ma

(9) Output to Penetration Aid No. 2 Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohm maximum load

(b) False: Less than 100 ma

(10) Output to Penetration Aid No. 3 Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohm maximum load

(b) False: Less than 100 ma

(11) Output to R/V Prearm Command Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohm maximum load

(b) False: Less than 100 ma

(12) Output to R/V Electrical Disconnect Command Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohm maximum load

(b) False: Less than 100 ma

II. RECOMMENDED SOLUTION (Continued)

A. FUNCTIONAL DESCRIPTION (Continued)

c. Control and Discrete Unit (P94) (Part of Fig. A #6275) (Continued)

1. Performance (Continued)

b. Discrete Amplifier Assembly Requirements (Continued)

(13) Output to Phase I Retro Rocket Command Ordnance Load:

(a) True: 40 amps minimum into a ________ ohms maximum load

(b) False: Less than 50 ma

(14) Output to Pitch Rocket Command Ordnance Load:

(a) True: 9 amps minimum into a 0.5 ohm maximum load

(b) False: Less than 100 ma

(15) Output to Phase II Retro Rocket Command Ordnance Load:

(a) True: 45 amps minimum into a ________ ohm maximum load

(b) False: Less than 50 ma

(16) Ordnance Monitor Outputs:

(a) True: -11 to -25 VDC; Max. current: .5 ma at -11 volts

(b) False: +5.5 to +25 VDC; Max. current: 1.5 ma at +5.5 volts

(17) For a "true" input command, the monitor output will not indicate "true" for a period in excess of 20 ms if load lines are not terminated.

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION

1. Power

a. NS17 (Fig. A #6275) Guidance Power

1. Voltage: 28 ± 1 vdc measured at sense point.

2. Ripple voltage: 300 mv rms or 1v peak-to-peak measured in a resistive load at the umbilical.

3. Nominal current:

(a) DCU only:

(1) +28 vdc Power Supply:
6 amps, with no greater than a 20 kc
ripple to exceed 10% magnitude peak-to-peak.

(2) +400 cps Power Supply:
2.5 amps/phase steady-state current.

(b) DCU and IMU

(1) 400 cps supply: ______

(2) Platform servos: ______

(3) G&C, DC Converter: ______

(4) Computer P.S.: ______

4. In-rush current. The DCU and IMU will not be turned on simultaneously.

(a) DCU in-rush; the ground power equipment will see 2000 microfarads through a diode.

(b) IMU in-rush; this will be a change from DCU load, (3a) to DCU and IMU load, (3b). The rapidity of the change is determined by transistor switches.

5. Maximum rate of change of current (except during in-rush), 5a. per 20 rms.

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

1. Power (Continued)

a. NS17 (Fig. A #6275) Guidance Power (Continued)

6. The load shall cause no transiet overcurrent greater than 140 ± 10% of full rated load for a period greater than 5 to 10 ms. Internal power supply trip circuit protection may be used provided it doesn't shut down for currents less than 130% of maximum rated for a period less than 5 ms or during in-rush.

7. Remote sense leads will be provided to the G&C umbilical.

8. Monitoring: At the G&C unbilical:

(a) Gross overvoltage - 32.0 ± 0.5 vdc

(b) Marginal overvoltage - 29.5 ± 0.5 to 32.0 ± 5 vdc

(c) Marginal undervoltage - 26.5 ± 0.5 to 24.u ± 0.5 vdc

(d) Gross undervoltage - 24.0 ± 0.5 vdc

b. P92 (Part of Fig. A #6275) Power Requirements

(1) Ground Power - The P92 shall be supplied by the following ground power sources. The voltage shall be measured at the umbilical.

(a) Electronics 28 ± (2.0) vdc

(b) Hydraulic 29 ± (4.0) vdc

(2) Airborne Power - The electronics and the hydraulics will obtain their electrical power from a common third stage battery with a voltage of 29 ± 1.05.

c. Gyro Start Voltage

(1) Range: 39.5v to 45vdc. The objective is to operate near the lower limit, i.e., near 40v as practicable.

(2) Gyro start current sees an inductive input with 5a maximum in-rush returning to normal within 50 ms.

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

1. Power (Continued)

c. Gyro Start Voltage (Continued)

(3) Turn-on relationships; gyro start voltage will be applied under DCU control.

(4) Transient over-current; internal power supply trip circuit protection may be used provided it doesn't shut down for specified short duration overcurrents or in-rush current. s

(5) Monitoring; a voltage less than 39.25 ±0.5 vdc or greater than 45.0.5 vdc will result in an alarm status signal being generated.

2. Physical

a. Weights

(1) The total weight of the NS17, (Fig. A #6275) is 226.7 pounds. This weight is distributed as follows:

(a)	CD-1 body section	37.4 pounds
(b)	Stable platform	49.3 pounds
(c)	Guidance electronics unit	23.0 pounds
(d)	D37 computer	33.0 pounds
(e)	Electro-Magnetic Shield	1.5 pounds
(f)	P92 control and discrete unit	23.5 pounds
(g)	Structure and platform housing	36.0 pounds
(h)	Cabling	17.0 pounds

b. Dimension

(1) The shape of the NS17 (Figure A #6275) is that of a truncated cone of the following dimensions:

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

2. Physical (Continued)

b. Dimension (Continued)

(1) (Continued)

(a) Length 31.5 inches

(b) Diameter (aft) 37.5 inches

(c) Diameter (forward) 32.5 inches

(i) D37B

(aa) Dimensions in inches: (Required)

18.870 x 5.860 x 10.050

(bb) Volume (cu. ft.)

0.36 Displacement Volume

(ii) Platform

The platform is a 18.5 in. diameter sphere

3. Interfaces (See Table I, Fig. A Equivalents).

Table I

Figure A Equivalents

A/N Nomenclature	Fig. A #
Stage 3 Battery (SE13G)	6210
Stage 1 Battery (SE13G)	6210

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

3. Interfaces (Continued)

Table I

Figure A Equivalents

A/N Nomenclature	Fig. A #
P68 AAU	6282
P90 Stage II TCVU	6262
P91 Stage III NCU	6263
P92 Control & Discrete Unit	(Part of Fig. A #6275)
P89 Stage I NCU	6261
D37B Computer	(Part of Fig. A #6275)
D43 Electromechanical Decoder	6250
C163 Signal Data Converter	13000
D20E CTLI	
Digital	———
Data Programmer	
D24C CTLI	
Analog	———
Multiplexer	

a. Electrical - Airborne & OGE

Aid Drawings

1. Stage 3 Battery/DMU/D37/P68, P90, P91, P92, P89 - 200 40 - 111
2. Stage 1 Battery/P89 - 200 41 - 111
3. Window Heaters/NS17 - 200 45 - 111
4. D37/DMU - 200 46 - 111
5. D43/C163/D37/P92A - D10011- 111

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

3. Interfaces (Continued)

a. Electrical - Airborne & OGE (Continued)

Aid Drawings (Continued)

6. P92A/D37B - 30072-111

7. C163A/NS17 - D10008-111

8. D20E/D37B - D10055 - 111

9. SE144/D37B - 20047 - 111

b. Electrical - MGE

Aid Drawings

C162/Portable Azimuth Alignment Set tester - 200 48 - 111

c. Mechanical

Aid Drawings

1. N17/D37 - 200 50 - 111

2. Stage 3 Battery/N17 - 200 51 - 111

3. P92/N17 - 200 53 - 111

4. Autonavigator Support Ring/N17/Autonavigator Hoisting Sling Cover - 200 54 - 111

5. Autonavigator Support Ring/Autonavigator Transfer Fixture - 200 55 - 111

6. Autonavigator Support Ring/Autonavigator Hand Truck - 200 56 - 111

7. Autonavigator Support Ring/Shipping Container

REV SYM F

VOL. SEC I NO D2-30044-3A PAGE 110

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

3. Interfaces (Continued)

c. Mechanical (Continued)

Aid Drawings (Continued)

8. IMU/CD-1 - 200 59 - 111

9. NS17/TD-1 = 200 60 - 111

10. Cabling and Wire Harness - 200 61 - 111

11. Stage I Battery/P89 - 200 61 - 111

d. Interface Control Drawings (ICD's)

(1) Electrical

Stage III Cable (P94) __________
Guidance and Control Umbilical __________

(2) Mechanical

(a) Stage 3 Engine structure __________

(b) Re-entry Vehicle (R/V) __________

e. Quantitative Description

DCU Interface Signal Description

(1) D37B IMU

Discrete

10 Monitor Inputs

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

3. Interfaces (Continued)

e. Quantitative Description (Continued)

DCU Interface Signal Description (Continued)

(i) D37B/DMU (Continued)

Discrete (Continued)

14 Command Outputs

1 Phase Register Output

Incremental

14 Resolver Inputs

8 Command Outputs

(ii) D37B/Flight Control (P92) Interface

Discrete

47 Monitor Inputs

31 Command Outputs (Including 3 EM Decoder Commands)

3 Phase Register Outputs

Analog Voltage

15 Monitor Inputs

4 Command Outputs

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

3. Interfaces (Continued)

e. Quantitative Description (Continued)

DCU Interface Signal Description (Continued)

(ii) D37B/Flight Control (P92) Interface (Continued)

Incremental

2 Binary Inputs

Character

1 Timing Output

(iii) D37B/D43 Electromechanical Decoder

Discrete

2 Monitor Inputs

DC Voltage

1 Sense Voltage Output

(iv) D37B/OGE Operational Ground Equipment

Discrete

9 Monitor Inputs

1 Special Disable Input

2 Command Outputs

REV SYM

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

3. Interfaces (Continued)

e. Quantitative Description (Continued)

DCU Interface Signal Description (Continued)

(iv) D37B/OGE Operational Ground Equipment (Continued)

Character

5 Character Data Inputs

1 Sprocket Timing Input

4 Character Data Outputs

1 Character Parity Output

1 Character Timing Output

External Operating Control

3 Control Inputs

Monitor Outputs

2 Mode Indicators

1 Error Indicator

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

3. Interfaces (Continued)

e. Quantitative Description (Continued)

DCU Interface Signal Description (Continued)

(v) D37B/Ground Electronics System

Communications

1 Precision Time Incremental Pulse

1 Cable Gated Timing Input

1 Radio Status Data Output

1 Cable Status Data Output

1 Cable Status Ready Output

(vi) DCU Connectors

(a) Power connectors

One 4 pin connector for the 400 CPS Power supply

One 4 pin connector for the +28 v Power supply

(b) Input/output connectors

Five 61 pin connectors

(vii) DCU Total Power Input

172.4 watts nominal from +28vdc Power supply
40 watts nominal from 400 cps Power supply
212.4 watts nominal total power input

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

4. Environmental

The NS17 (Fig. A #6275) design will meet the ambient and dynamic environmental requirements as defined in AF/BSD Exhibit 62-51 and its applicable document with the exceptions listed in the supplement.

II. RECOMMENDED SOLUTION (Continued)

B. DESIGN DESCRIPTION (Continued)

5. Weapons Effects

The NS17 (Fig. A #6275) design will meet the weapons effects requirements as defined in the applicable paragraphs as set forth in AF/BSD Exhibit 62-85 subject to the exceptions listed in the supplement.

6. Monitoring at Launch Facilities Requirements:

NS17 (Fig. A #6275) signals will be monitored via the D37B computer (Part of Fig. A #6275).

The D37B computer shall monitor the Weapon System in accordance with requirements set forth by the Ground Operations Mode - Maintain Readiness, Monitor and Launch. The computer shall maintain monitor capability through use of the Ground Signal Converter (C163) (Fig. A #13030) and the Ground Electronics System (GES).

The P92 (Control and Discrete Unit (Part of Fig. A #6275) will be monitored as described in II C1A(8) of the Recommended Solution section of this Figure A.

7. Operating Life

The NS17 (Fig. A #6275) design will be the operating life requirements of AF/BSD Exhibit 62-123 and 62-58.

8. Safety Considerations

The NS17 (Fig. A #6275) design will meet the safety requirements as specified in AF/BSD Exhibit 62-82.

9. Special Consideration - Not Applicable

C. OPERABILITY AND MAINTAINABILITY

The NS17 (Fig. A #6275) will be designed and fabricated to allow interchangeability between major subassemblies. The IMU will be interchangeable with the addition of an addendum tape.

D. RELIABILITY

The NS17 (Fig. A #6275) will be designed to meet the requirements of Exhibit R of Letter Contract AF04(694)-247.

E. REFERENCE DOCUMENTS

EM 0662-185

Type of List: **OPERATIONAL GROUND EQUIPMENT**

Date: 30 October 1962
REVISED: 11 March 1963

List Number:

Model Designation and Name of End Item: HARDENED (SM-80 WEAPON SYSTEM)

Contractor: AUTONETICS

Contract No.: AF 04(647)-599

Quantity:

Revision No.:

ITEM NO.	FUNCTIONAL CLASS INDEX	STOCK NUMBER: Fed Supply Class	STOCK NUMBER: Federal Item Identification Number	STOCK NUMBER: Manufacturer's Part Number	NOMENCLATURE AND FED. MFR'S CODE	TECH DESCR DATA OF PROBLEM AREA	UNITS	BASIS OF ISSUE AND QUOTA ALLOCATIONS: SILO	LCC	SMSA	VAFB			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGNIZANT CENT & SERVICE	STATUS CLASS	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST AVAIL DATE FOR FIRST ITEM	EST PROD LEAD TIME	DATE OF ARDC APPR.	END ITEM EFFECTIVITY	EQUIPMENT SECURITY CLASSIFICATION AND REMARKS
1	2	3			4	5	6	7						8	9	10	11	12	13	14	15	16	17	18	19
602.3	AA-19	MBAH 4935		67214-107	Collimator Set AN/GJQ-22 94756			X			X				* $8,100			PEC	CFE			3 mos	1-63	W-3 & Subs VAFB	Form B 25-33500 Form B 25-33512

I. TECHNICAL REQUIREMENTS

A. FUNCTIONAL REQUIREMENTS

A means is required for establishing and sustaining the platform of the NS10 Missile Guidance Set in alignment with a highly accurate azimuth reference, at the launcher. The equipment must be capable of providing necessary azimuth error signals, in a digital coded form, via the Control-Guidance Coupler (Item 604.2), to the D17 airborne computer to monitor and correct the position on the platform in relation to the target azimuth. These error signals are required to be indicative of the azimuth misalignment angle, ϕ (phi) with respect to the quantization reference direction. (The quantization reference direction serves as a reference for specification of the output states, and can be interpreted as the azimuth direction of the effective optic axis of this equipment.)

B. DESIGN CONSTRAINTS

1. Power - The equipment shall be capable of operating from the Control-Guidance Coupler power source of 120V ± 2.4 rms, 400 cps (+35, -20), single phase.

2. Physical - The equipment shall be able to traverse a circular opening of forty (40) inches.

3. Interface - The equipment shall be used in direct electrical interface with the Collimator Test Set (C143), Control-Guidance Coupler (C53) and functional interface with the Optical Alignment Set (C96) and Missile Guidance Set (NS10).

* The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

FIGURE A 602.3
SHEET 1 OF 9

PREPARED BY

11 March 1963

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

4. Environmental - Environmental protection shall maintain requirements specified in Weapon Specification S-133-2, paragraph 3.2.4 Revision IV, dated Dec 1958 and STL Document R-7410.5.2-227, dated 14 Sept 1960.

a. Ambient

(1) Non-operating

(a) Altitude

(b) Temperature

(2) Operating

(a) Altitude

(b) Temperature

b. Dynamic

(1) Non-operating

(a) Vibration

(b) Shock

c. Humidity

d. Fungus

e. Sand and Dust

f. The equipment in its operating configuration shall meet the electro-interface requirements specified in STL Document, GM07-59-2617A.

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS (Cont'd)

5. Weapons Effects - Not Applicable

6. Monitoring - Not Applicable

7. Operating Life - The equipment shall be capable of operating for a period of 3 years without encountering wear-out, out-of-tolerance, characteristic drifts, or similar problems of aging.

8. Safety Considerations - Not Applicable

9. Special Considerations - Not Applicable

C. OPERABILITY AND MAINTAINABILITY

1. The equipment shall be designed to minimize the skill, experience, and time necessary for assembly and operation. The construction of parts shall be such as to eliminate the possibility of improper insertion of plug-in modules or improper connection of cable connectors. The arrangement and configuration of controls and displays shall minimize human error and fatigue.

2. The equipment shall be designed to provide accessability for checking, adjusting, maintenance, and repair with minimum disturbance to other parts and with the use of a minimum quantity and variety of special tools.

D. RELIABILITY

1. Selection of parts and processes shall be such to meet the operating life and environmental requirements. The equipment shall be designed to achieve not less than 175,000 hours MTBF.

E. APPLICABLE DOCUMENTS

1. MIL-STD-803 - Human Design Standards for Missile System Equipment, 5 November 1959.

2. MIL-STD-130A - Identification Marking of U.S. Military Property, 8 September 1958.

3. S-133-2 - Weapon Specification Revision IV, dated December 1958, as amended by STL Document R-7410.S2-227, Minuteman Ground Equipment and Airborne Shock, Acceleration and Vibration Environmental Requirements, dated 14 September 1960.

11 March 1963

I. TECHNICAL REQUIREMENTS (Cont'd)

E. APPLICABLE DOCUMENTS (Cont'd)

4. 6120-7256-OU-000 - Minuteman Qualification Test Criteria, 12 February 1962.

5. STL Document GM07-59-2617A - Electro-Interference Control Requirements for Minuteman (WS-133A) dated 20 October 1959.

6. AFBM Exhibit 58-22 - Guidance and Control System Design Criteria, Revision II, dated 25 November 1960, including changes No. 1 through No. 30, Section III only.

II. RECOMMENDED SOLUTION

A. FUNCTIONAL DESCRIPTION - It is recommended that equipment designated as Collimator Set, AN/GHQ-22 (C21C) be designed and fabricated to fulfill the above technical requirements. The Collimator Set will perform the following functions and have the indicated physical description:

1. The Collimator Set is a single axis photo-electronic collimator, with an appropriate mounting, and is capable of transferring the azimuth reference direction to the autonavigator azimuth axis, and generating a signal in digital coded form that indicates platform azimuth alignment conditions. The azimuth error signals, which may be designated as AC_1, and AC_2, are required to provide azimuth error information according to the following table:

AC_1	AC_2	AZIMUTH ERROR INFORMATION
1	0	ϕ is more positive than, or equal to +1.2 ± 0.5 sec from quantization reference direction.
0	1	ϕ is more negative than, or equal to -1.2 ± 0.5 sec from quantization reference direction.
0	0	ϕ is smaller than ± 1.2 ± 0.5 sec from quantization reference direction.
1	1	Insufficient return light detected by the alignment equipment.

The + (plus) sign and the - (minus) sign preceding the number 1.2 in the above table denotes counterclockwise and clockwise rotation of the target mirror respectively, when viewed from above.

An AC_1 or AC_2 "0" code is defined as 3±1 ma dc flowing between the C21Q and C53.

An AC_1 or AC_2 "1" code is defined as less than 0.4 ma dc flowing between the C21Q and C53.

11 March 1963

II. RECOMMENDED SOLUTION (Cont'd)

A. FUNCTIONAL DESCRIPTION (Cont'd)

2. When operating within a field-of-view limited to ± 4 $\widehat{min}$ in elevation and ± 75 $\widehat{sec}$ in azimuth, the Collimator Set will be capable of operating with the platform mirror at a maximum range of eleven (11) feet as measured from the mirror to the Collimator Set and including the window attenuations in the Missile Guidance Set (NS10) and missile structure. Collimator Set adjustments will accommodate offsets of the missile guidance compartment up to six (6) inches horizontally and up to one (1) inch vertically in increments not greater than one-half inch. Continuous adjustment at ± 5 degrees in azimuth, ± 2 degree in elevation and ± 8 degrees in roll will be provided in the Collimator Set. A two-axis level indicator will be provided as a reference for the horizontal axis of the photo-electronic collimator.

3. The elevation field-of-view will be a minimum of ± 50 $\widehat{sec}$ (above and below the optic centerline) with not more than ± 1.2 $\widehat{sec}$ azimuth degradation; and up to 4 $\widehat{min}$ above and below the optic centerline with not more than ± 5.8 $\widehat{sec}$ azimuth degradation. Translation movements of a one-inch diameter target mirror up to 1/4 inch in any direction from the optic centerline will not result in an azimuth degradation greater than 1.2 $\widehat{sec}$; translation movements up to 1-1/2 inches in any direction from the optic centerline will not result in an azimuth degradation greater than 3 $\widehat{sec}$. Azimuth shift will not be greater than 2.5 $\widehat{sec}$ for a temperature change of ± 10 degrees from 70F, and will not be greater than 6 $\widehat{sec}$ for a temperature change of +30 -10 degrees from 70F. Azimuth shift during any 24 hour period will not cause a 1, 0, or 0, 1 on AC_1, AC_2 to occur continuously for more than 1.0 second of time under constant ambient temperature.

4. An external test capability will be provided to permit use of the C143Q Collimator Test Set in accordance with Figure A 717.2.

B. DESIGN DESCRIPTION

1. Power - The power for the Collimator Set will be routed by the Control-Guidance Coupler (C53) and are as follows:

(a)	Voltage:	120 ± 2.4 vac rms
(b)	Frequency:	380 to 435 cps
(c)	Transient Regulation:	± 10 percent with maximum recovery time of 100 milliseconds.

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

1. Power (Cont'd)

(d) Harmonic Content: 10 percent (maximum)
(e) Power: 25 watts (minimum)

2. Physical Description - The Collimator Set shall consist of the following major components with approximate dimensions:

	Nomenclature	Length	Width	Height	Weight
a.	Collimator, Photo-Electronic, SU-16/GJQ-22	18 in.	10 in.	12.5 in.	45 pounds
b.	Mounting, MT-2847/GJQ-22	12 in.	16 in.	11.0 in.	50 pounds
c.	Loose Equipment - (Adapters and Misc. Hardware)	----	----	----	--------

3. Interface - The Collimator Set will be physically mounted and clamped to slide rails which are attached to the launch facility equipment room bench support. The Collimator Set will be electrically connected by cabling from the Control-Guidance Coupler (C53).

4. Environment

a. Ambient

(1) Non-operating

(a) Altitude - The Collimator Set shall withstand pressures representing sea level to 50,000 feet (3.4 inches Hg).

(b) Temperature - The Collimator Set shall withstand surrounding air temperature of -80F. (during air transportation) and -35F (during ground handling) to a maximum of 125F. (sheltered) and 160F (unsheltered). The air temperature may change at rates of 1.8F. per sec. maximum.

11 March 1963

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

4. Environment (Cont'd)

a. Ambient (Cont'd)

(2) Operating

(a) Altitude - The Collimator Set shall withstand pressures representing sea level to 10,000 feet.

(b) Temperature - The Collimator Set shall withstand surrounding air temperature ranging from 60F to 100F.

(3) Test performance shall be in accordance with 6120-7256-OU-000 Paragraph 5.3.

b. Dynamic

(1) Non-operating

(a) Vibration - The Collimator Set shall withstand complex vibration of the following amplitudes:

Frequency	Amplitude
5 - 50 cps	3.5g rms (limited to .4 inch P/P displacement)
50 - 300 cps	1.5g rms

(b) Shock - The Collimator Set shall withstand handling shocks involved in free drops of one inch maximum, and pivot drops of four inches maximum. Corresponding acceleration peaks may be 100g on the bare unit or, if provided, on its handling case.

(c) Test Performance shall be in accordance with 6120-7256-OU-000 Paragraph 5.1 and 5.2.

c. Humidity - The Collimator Set shall be subjected to a humidity test, while not operating, in accordance with 6120-7256-OU-000, Minuteman Qualification Test Criteria paragraph 5.4.

d. Fungus - The Collimator Set shall be subjected to a fungus test, while not operating, in accordance with 6120-7256-OU-000, Minuteman Qualification Test Criteria paragraph 5.5.

11 March 1963

II. RECOMMEND SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

4. Environment (Cont'd)

e. Sand and Dust - The Collimator Set shall be subjected to a sand and dust test, while not operating, in accordance with 6120-7256-OU-000, Minuteman Qualification Test Criteria paragraph 5.6.

f. Electro-Interference - The Collimator Set, in its operating configuration, shall meet the electro-interference requirements specified in STL Document GM07-59-2617A.

5. Weapons Effects - Not applicable.

6. Monitoring - Not applicable.

7. Operating Life - The operating life shall meet the requirements as defined in Minuteman Qualification Test Criteria, 6120-7256-OU-000, February 12, 1962.

8. Safety Considerations - Not applicable.

9. Special Considerations - Not applicable.

C. OPERABILITY AND MAINTAINABILITY

1. The collimator mounting for collimator/silo interface will be such to provide ease of handling, installation, and adjustment.

2. Collimator optical components, mounting and adjustment controls will be positioned to provide ease of operation.

3. The Collimator Set will contain removable plug-in components for ease of maintenance.

4. The Collimator Set will conform to the specifications set forth in AFBM Exhibit 57-8A, Human Engineering Design Standards for Missile System Equipment, 1 November 1958.

D. RELIABILITY - Selection of parts and processes shall be such to meet the operating life and environmental requirements and will assure a MTBF of not less than 175,000 hours.

II. RECOMMEND SOLUTION (Cont'd)

E. REFERENCE DOCUMENTS

1. AFBM Exhibit 57-8A, Human Engineering Design Standards for Missile System Equipment, 1 November 1958.
2. EM 1914-1 Specification for Packaging Performance Methods, WS-133A.
3. 00008-111, Autonetics Interface Document C53/C21
4. 20025-111, Autonetics Interface Document C21/C143

A TYPE OF LIST	B MODEL DESIGNATION	C SUB SYSTEM IDENTIFICATION	D CONTRACTOR
[illegible] GROUND EQUIPMENT	SM-80 WEAPON SYSTEM		THE BOEING [illegible]

E FIGURE A NUMBER	F MILITARY NOMENCLATURE AND FED. MFR'S CODE	G COMMON NOMENCLATURE	H ORIGINATION DATE	J AFBSD APP DATE	K CONTRACT NO.
12.2	RETRACTOR, GUIDANCE AND CONTROL UMBILICAL CABLE RMU-6/E		12/ 8/[illegible]	1-17-3	AF04(694)-2[illegible]

L REVISIONS: 1 Revision Date	2 Code	3 Initiated By	4 AFBSD Approval Date	M Functional Class Index	N Stock Number: 1 Fed. Supply Class	2 Federal Item ID Number	3 Manufacturer's Part Number	P Basis of Issue and Quota Allocations: 1 LF	2 LCF	3 MLCC	4 SMSB	5 SRA	6 MAMS	7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod Lead Time	X End Item Effectivity	Y Remarks
3[illegible]			1-17-[illegible]																	C[illegible]			[illegible]	2 72 3 2

I UMBILICAL REQUIREMENTS

A requirement exists for a means to:

1 Retract the G&C umbilical assembly from the flight path of the missile after the umbilical has been released from the missile.
2 Afford support to the umbilical to avoid exceeding the allowable stress parameters of the G&C section structure
R * 3 Withstand nuclear shocks to which the launcher is subjected per Para. 19 1.1 & 19 1.2 of D2-30028-2 dated 25 March 63.
4 Prevent transmission of above allowable shock load to the G&C Section.

II RECOMMENDED SOLUTION

It is recommended that a G&C Umbilical Retraction Mechanism be provided and consists of the following

1 Ballistic Rotary Actuator - The ballistic rotary actuator will be capable of:

a. Functioning when actuated by a pyrotechnic squib energized by a 28-volt d.c. signal

R * b. **Reeling cable on a drum to retract and secure the G&C umbilical cable in such a manner that it will remain outside of the flight path during launch.**

SHEET 1 OF 2 NOMENCLATURE RETRACTOR, GUIDANCE AND CONTROL, UMBILICAL CABLE RMU 6/E FIGURE A NUMBER [illegible]

2-6834-0-5

II. RECOMMENDED SOLUTION

R * c. Maintaining a slight tension on the aircraft cable in the extended position to eliminate cable slack.

* d. Playing the aircraft cable in and out to accommodate relative motion of the missile to the launcher while maintaining (c).

* 2. Actuator Support Structure-The Ballistic Rotary Actuator will be mounted on support structure provided as part of the Launcher facility.
The Actuator Support Structure will be integral to the launch tube liner and will accept the umbilical head to avoid excessive protrusion of the umbilical head into the launch tube.
The centerline of the support structure will be positioned 42.0 inches of arc at the launch tube liner diameter, CCW (When viewed from above) from the radial line which passes through the G&C umbilical and missile vertical centerline.

R * 3. Umbilical Cable Support Structure - Support provisions for the umbilical cable will be provided, integral to the launch tube liner of the launcher facility.
These provisions will be limited to the necessary structure to accept the fittings which will secure the G&C Umbilical cable.
The support will be positioned to support the umbilical cable approximately on the radial line which passes through the G&C umbilical and the missile vertical centerline.

4 Umbilical Plug Support Assembly - The umbilical plug support assembly will attach to the umbilical plug and react the vertical moment imposed on the missile structure, due to the dead weight of the G&C umbilical, through a pad resting on the missile.

R This Figure A is similar to Figure A 1202 Revision D except where noted by an (*).

TYPE OF LIST: A OPERATIONAL GROUND EQUIPMENT

MODEL DESIGNATION: B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION: C ENVIRONMENT

CONTRACTOR: D THE BOEING COMPANY

FIGURE A NUMBER: E 1214

MILITARY NOMENCLATURE AND FED. MFR'S CODE: F COOLER, LIQUID, GUIDANCE SECTION MXK-118/F37U

COMMON NOMENCLATURE: G

H ORIGINATION DATE: 12/32

J AFBSD APP DATE: 1-17-3

CONTRACT NO.: AF04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
	6A		1-17-3																					
[illegible]	6A	In-House																		CFE			W-6	
[illegible]	6A	PDP																						

I. TECHNICAL REQUIREMENTS 2.58

A requirement exists to maintain the temperature of the G&C Compartment within $\pm$ 0.24^{o} F of a nominal set point which is between 66.5^{o} F to 68.5^{o}F at the thermistor. The equipment provided to meet this requirement *must perform the following specific functions:* 2.58.4 2.58.4.1

A. Utilise the signal provided by the thermistor, located in the G&C Compartment, to provide the following signals: 2.58.4.1.1

1. A control signal to control coolant flow. 2.58.4.2
2. An "Alarm" signal to the Signal Data Converter* that indicates that the thermistor temperature has exceeded the nominal set point by 0.5^{o} F. 2.58.4.3 2.58.4.3.1
3. A "No-Go" signal to the Signal Data Converter* that will indicate that the thermistor temperature has exceeded 90^{o} F $\pm$ 4^{o} F. 2.58.4.3.1.1
4. A "Gross Temperature" signal to the Startup and Targeting equipment (see 25-18839-1.7) to inhibit applying power to the missile G&C system if the compartment temperature at the thermistor has exceeded 80^{o} F $\pm$ 4^{o} F. 2.58.4.3.1.2 2.58.4.3.2.3

B. It is a requirement that a chilled solution of 0.2% sodium chromate (by weight) and highly purified* water, be used as the coolant to remove the heat generated in the G&C Compartment. 2.58.4.4

SHEET 1 OF 4 NOMENCLATURE COOLER, LIQUID, GUIDANCE SECTION FIGURE A NUMBER 1214

2-6836-0-5

I. **TECHNICAL REQUIREMENTS** (Continued)

C. Coolant must be circulated to the G&C umbilical. A maximum flow rate of 7* lbs/min. at a maximum pressure of 20 psi is required at the inlet to the G&C Compartment.

D. Control the flow and maintain the coolant temperature at $40^\circ \pm 2^\circ$ F*.

R E. Provide coolant to the G&C Compartment during a 6 hour emergency period, during which 37.7 to 28 VDC* power is available, and the same functional requirements exist as stated in A (1), A (2), A (3), C and D.

F. The equipment must be packaged in a standard electronic equipment rack and protected from shock and vibration.

G. Limit the current across the thermistor in the G&C Compartment during normal operation (thermistor temperature between 66.5° and 68.5°) to no more that 0.8 milliamperes.

H. The equipment must have a power transfer device to detect loss of AC power and to effect activation of the DC pump motor and intertank solenoid valve.

II. **RECOMMENDED SOLUTION**

It is recommended that equipment be provided to satisfy the above requirements which will function as follows:

A. Provide a balanced bridge electronic control system which will receive the thermistor signal from the G&C Compartment and amplify voltage obtained from the bridge to be used as follows:

1. Operate a flow control valve that will allow the correct amount of coolant to flow through the G&C section to maintain the thermistor temperature at a nominal set point temperature between 66.5° and 68.5° within a tolerance of $\pm 0.2^\circ$ F.

2. Operate an "Alarm" signal relay or semi-conductor that will transmit a signal to the Signal Data Converter* indicating that the temperature at the G&C thermistor has exceeded the nominal set point, by $\pm 0.5^\circ$ F.

(Continued)

II. RECOMMENDED SOLUTION

A. (Continued)

3. Operate a "Gross-Temperature" signal relay or semi-conductor that will transmit a signal to the startup and Targeting equipment that will inhibit applying power to the G&C compartment if the compartment temperature at the thermistor has exceeded $80^{\circ} \pm 4^{\circ}$ F.

4. Operate a "No-Go" signal relay or semi-conductor that will transmit a signal to the Signal Data Converter* that will indicate when the thermistor temperature has exceeded 90° F $\pm 4^{\circ}$ F.

B. Provide a chiller unit with a compressor, a condenser, hot gas bypass valve, a heat exchanger and controls. The unit is sized to carry the heat load generated by the G&C cooling system and to maintain an adequate amount of stored coolant (storage tanks provided - Figure A 1317) for use during the emergency period. This unit is controlled by a sensor on the heat exchanger inlet line.*

C. Provide a pump to transfer chilled coolant from the storage facilities through a control valve, chiller and G&C compartment heat exchanger back to the storage facilities during normal operation, utilizing 120/208 volt, three phase, 60 cycle AC power.

D. Provide an Electrical Control Valve that will respond to the signal as described in Item A (1) above to modulate the flow of chilled coolant through the G&C compartment heat exchanger.

R E. Provide a 37.7 to 28 VDC* pump to transfer chilled coolant from the storage tank through a control valve, G&C compartment heat exhanger back to the storage tank for the 6 hour emergency period. The coolant will be controlled by the same control valve as described in Paragraph D (Section II) above.

R F. Provide 37.7 to 28 VDC* signal to close the intertank solenoid valve (part of Figure A 1318) during the six hour emergency period.

G. The equipment will be compatible with the coolant used and will be * mounted in a standard equipment rack with the pump package mounted in the bottom portion of the rack, the chiller package in the center and the electrical control in the top. All components mounted in the rack will withstand a vibration load of 7.5 g's applied in all directions. The rack will be mounted on the shock mounted floor of the LF equipment room.

(Continued)

II. RECOMMENDED SOLUTION

A. (Continued)

3. Operate a "Gross-Temperature" signal relay or semi-conductor that will transmit a signal to the startup and Targeting equipment that will inhibit applying power to the G&C compartment if the compartment temperature at the thermistor has exceeded $80^{\circ} \pm 4^{\circ}$ F.

4. Operate a "No-Go" signal relay or semi-conductor that will transmit a signal to the Signal Data Converter* that will indicate when the thermistor temperature has exceeded 90° F $\pm 4^{\circ}$ F.

B. Provide a chiller unit with a compressor, a condenser, hot gas bypass valve, a heat exchanger and controls. The unit is sized to carry the heat load generated by the G&C cooling system and to maintain an adequate amount of stored coolant (storage tanks provided - Figure A 1317) for use during the emergency period. This unit is controlled by a sensor on the heat exchanger inlet line.*

C. Provide a pump to transfer chilled coolant from the storage facilities through a control valve, chiller and G&C compartment heat exchanger back to the storage facilities during normal operation, utilizing 120/208 volt, three phase, 60 cycle AC power.

D. Provide an Electrical Control Valve that will respond to the signal as described in Item A (1) above to modulate the flow of chilled coolant through the G&C compartment heat exchanger.

R E. Provide a 37.7 to 28 VDC* pump to transfer chilled coolant from the storage tank through a control valve, G&C compartment heat exhanger back to the storage tank for the 6 hour emergency period. The coolant will be controlled by the same control valve as described in Paragraph D (Section II) above.

R F. Provide 37.7 to 28 VDC* signal to close the intertank solenoid valve (part of Figure A 1318) during the six hour emergency period.

G. The equipment will be compatible with the coolant used and will be * mounted in a standard equipment rack with the pump package mounted in the bottom portion of the rack, the chiller package in the center and the electrical control in the top. All components mounted in the rack will withstand a vibration load of 7.5 g's applied in all directions. The rack will be mounted on the shock mounted floor of the LF equipment room.

(Continued)

II. **RECOMMENDED SOLUTION** (Continued)

G. (Continued)

Specifically, the equipment will consist of:

1. A chiller with a temperature sensor in the coolant system.

R 2. An electronic bridge and amplifiers using 37.7 to 28 VDC*

R 3. 37.7 to 28 VDC* flow control, valve.

4. 120/208 Volt, three phase, 60 cycle AC pump and motor*

R 5. A 37.7 to 28 VDC* pump and motor.

6. Relays or semi-conductors to transmit the "Gross-Temperature", "Alarm" and "No-Go" signals.

7. This equipment will be installed in a standard electronic rack with the necessary plumbing and electrical connectors. (See Figure A 1318 for description of plumbing set).

8. A coolant filter.

9. A relay powered by 2 phases of the 3 phase AC power with DC contactors normally closed. This relay will detect the loss of AC power and automatically effect the activation of the DC pump motor and intertank solenoid valve.

This Figure A is identical to Figure A 1214, Revision F except where noted by an *.

TYPE OF LIST A OPERATIONAL GROUND EQUIPMENT	MODEL DESIGNATION B SM-80 WEAPON SYSTEM	SUB SYSTEM IDENTIFICATION C POWER	CONTRACTOR D THE BOEING COMPANY
FIGURE A NUMBER E 1248	MILITARY NOMENCLATURE AND FED. MFR'S CODE F CABLE ASSEMBLY SET, LAUNCHER	COMMON NOMENCLATURE G	H ORIGINATION DATE 12/3/2 J AFBSD APP DATE 3-6-3 CONTRACT NO. K AF04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
[illegible]	A	E. Hume PDR	[illegible]																	CFE			W-6	2.57.52 2.57.53 2.57.55 2.57.56 2.57.57 2.57.60 2.57.61 2.57.62 2.57.63 2.57.64 2.57.65 2.57.66 2.58.4.3 2.60 2.60.1 2.60.2 2.60.3

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

1. A requirement exists to provide a transmission system within the Launcher, within the Launcher Equipment Building, and between the Launcher and the Launcher Equipment Building to transmit electrical power and/or signals to and/or from RPIE, OGE and MGE.

2. A requirement exists to provide a transmission system between the Launcher and the missile to transmit electrical power and signals and to provide a means to circulate coolant thru the G&C Section.

B. Design Constraints

1. Power

The Cable Assembly Set, Launcher, shall be designed to transmit power and/or signals having voltage, current and frequency characteristics of power and signals described in Paragraph 1B3., below.

2. Physical

The design concept of this equipment shall be similar to that of Figure A 1248.3 Rev. A, Cable Assembly Set, Launcher, with modifications to provide interface compatibility with Wing VI equipment.

I TECHNICAL REQUIREMENTS (Continued)

3. Interface

One or more cable assemblies shall be required to provide the following interconnections:

a. Between the following equipment and/or subsystems:

RPIE to OGE
Power Subsystem to all OGE
Power Subsystem interconnections
G&C Subsystem interconnections
GES Subsystem to G&C Subsystem
Environmental Control Subsystem to OGE
Security Subsystem interconnections
OGE to Missile Umbilical Connections

b. In accordance with the following interface documents:

R

ICD 25-38225 "Voice, Data and Message Processing Equip. & C163 Converter, Signal Data - Electrical"
ICD 25-38229 "C225 Power Converter - Electrical & Cooling"
ICD 25-26451 "C21 Collimator Set - Electrical"
ICD 25-38233 "Antenna tuner Unit-Electrical"
ICD 25-38235 "Radio Set, Command & Status - Electrical"
ICD 25-26402 "G&C Umbilical Connector - Electrical & Cooling"
ICD 25-26430 "Pullaway Umbilical Connector - Electrical"

Additional interface documents will defined the following areas :

Security Subsystem
Message Authentication System
Environmental Control System

R - c. The Cable Assembly Set, Launcher shall interface with RPIE as defined by applicable FCD's

4. Environment

The Cable Assembly Set, Launcher, shall function in nuclear shock and EMP environments defined by D2-30028-1, Paragraph 2.1.3.2 and 2.2.4 ; and an ambient environment defined by D2-30028-1, Paragraphs 2.1.2.2 A&B.

5. Weapons Effects

See Paragraph I.B.4, above.

I TECHNICAL REQUIREMENTS (Continued)

6. Monitoring

Not Applicable

7. Special Considerations

a. The G&C Umbilical Cable to the G&C compartment shall include the following features:

(1) Provision for connection of Hydraulic hose (Part of Figure A 1318)
(2) Means to provide remote disconnection

R b. Each cable assembly shall be designed in accordance with AFBSD Exhibit 62-77 Paragraphs 4.1.3, and 4.2 thru 4.5, and AFBSD Exhibit 62-84, Paragraphs 6.2 4.4- and 6.2.5D

c. The Cable Assembly Set, Launcher, shall physically reference the missile and each integral, metallic OGE box, rack, etc. to earth ground in accordance with AFBSD Exhibit 62-75, Paragraphs 2.3.2.1 and 2.3.2.2.

d. The cable assemblies shall conform with electrostatic and electromagnetic induced interference suppression requirements of AFBSD Exhibit 62-75, Section 2.1, and AFBSD Exhibit 62-87, Paragraphs 3.2.1 thru 3.2.7 and 3.2.9.2 thru 3.2.9.4.

e. Human Engineering shall be in accordance with D2-30028-1, Section 2.4.

C. Operability and Maintainability

The Cable Assembly Set, Launcher, shall utilize the maintainability concepts defined by D2-30028-1, Section 2.3.

D. Reliability

E. Applicable Documents

1. D2-30028-1, "WS-133B Operational Ground Equipment Design Discipline Document," Revision A, February, 1963.
2. D2-30028-2, "Structural Design Criteria - Operational Ground Equipment Minuteman Wing VI." February, 1963.
3. AFBSD Exhibit 62-77, "Electric Power and Cabling Subsystem Criteria, WS-133B," Revision I, 25 Ocotber, 1962. (Subject to deviation noted in D2-30028-1).
4. AFBSD Exhibit 62-75, "Electrical Grounding Criteria, WS-133B, "Revision I, 3 October 1962.

I. TECHNICAL REQUIREMENTS (Continued)

E. Applicable Documents (Cont'd.)

5. AF BSD Exhibit 62-87, "Electro-Interference Control Requirements for Minuteman", 6 December, 1962.
6. AF BSD Exhibit 62-84, "Standardization", Revision I, 10 October 1962

II RECOMMENDED SOLUTION

It is recommended that a system of electrical cable assemblies be designed and provided to transmit electrical power and/or signals between RPIE, OGE, MGE and the missile located within the Launcher and/or the Launcher Equipment Building. It is further recommended that a cable (G&C Umbilical) connection at the missile provide a means to connect a hydraulic hose to circulate coolant thru the G&C section.

The cable assemblies shall utilise materials and assembly procedures which will fulfill the technical requirements of section I above. Each cable assembly shall be composed of one or more of the following components:

R Insulated Wire
Multi-pin connector with crimp-type removable pins per BAC C47 Standard (Pyle-National ZZM)
Crimp -type terminal lugs
Metallic braided shields
Cable jacketing material
Coaxial cables with coaxial connectors
Assembly materials, i.e., potting compounds, shield terminating devices, insulating materials, molding material, dust covers, clamps, etc.

R The cable assemblies will be potted and molded per Process Specification D2-11701.
The cable assembly to the missile Guidance and Control compartment (G&C Umbilical) shall also include the following components:

Provisions for hydraulic hose connection at the umbilical connector
Connector plug dust cover

G&C Umbilical Release feature

Kellums Grip, as required

One or more cable configurations will be established for the following interconnections:

All RPIE to all OGE
All Power Subsystem interconnections

II RECOMMENDED SOLUTION (Continued)

All G&C Subsystem interconnections
All Security Subsystem interconnections
All Power Subsystem to all OGE
All C&S Subsystem to all G&C Subsystem
All Environmental Control Subsystem to all OGE
OGE to Missile G&C Umbilical connection
OGE to Missile Skirt Umbilical connection

The MGP circuit shall be continued from the Distribution Box, Figure A 1337, to the Launcher Ground Point by a #2/0 insulated wire.

R Each integral, metallic OGE box, rack, etc. installed on the Launcher Equipment Room shock isolated floor shall be physically bonded to the shock isolated floor by a flexible, braided metallic strap.

R All other integral, metallic OGE box, rack, etc. shall be physically bonded to the structure grounding system copper bus bar by a flexible, braided metallic strap or an equivalent insulated cable assembly.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE	CONTRACT NO.
E 1280	F ACTUATING AND LOCKING MECHANISM, LAUNCHER CLOSURE, ATU-26/E	G	H 12-11-6	AF04(694)-266
			J AFBSD APP DATE 1/25/3	

L REVISIONS: Revision Date 1	Code 2	Initiated By 3	AFBSD Approval Date 4	M Functional Class Index	N Stock Number: Fed. Supply Class 1	Federal Item ID Number 2	Manufacturer's Part Number 3	P Basis of Issue and Quota Allocations: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod. Lead Time	X End Item Effectivity	Y Remarks
	6A																							
2-25-3	6A	In-House																						
1-6-3	6A	PDR																		CFE			W-6	2.58.3.13 3.11.2 3.11.2.2 3.19.6 3.19.6.1 3.19.6.2 2.59 2.72.3.2 (1)

I. TECHNICAL REQUIREMENTS

A requirement exists for a means to:

A. Remove the launcher closure prior to missile launch (removal initiated 7 seconds before launch and completed prior to launch).

B. Retract the lock and maintain taut cables during maintenance removal of the launcher closure.

R *C. Protect the missile and equipment from the effects of nuclear attacks per paragraphs 16.1.1, 16.1.2 & 16.1.3 of D2-30028-2 dated 25 March

D. Delay entry into the launch tube.

R E. Cable clearance in accordance with Fig. 3 of AFBSD 62-123 dated 4 Jan. 63.

II. RECOMMENDED SOLUTION

It is recommended that:

A. A ballistic-power actuator be provided as a means of producing a short-time force to remove the closure.

B. Cables, passing over pulleys, be provided to interconnect the piston of the actuator and the launcher closure.

C. A lock, protruding into the closure, be provided which shall be retractable only when actuated by the actuator.

D. A secondary power connection be provided in the actuator to allow the retraction of the lock during maintenance operations requiring launcher closure removal.

*E. Shock attenuation and/or structural capability be provided in this system to prevent failure under multiple nuclear blast effects.

This Figure A is identical to Figure A 1280 Revision D, except where noted by an *.

SHEET 1 OF 1 NOMENCLATURE ACTUATING AND LOCKING MECHANISM, LAUNCHER CLOSURE, ATU-26/E FIGURE A NUMBER 128C

2-6834-0-5

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C POWER	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE	CONTRACT NO.
E [illegible]	F BATTERY, STORAGE, LAUNCHER	G	H 12-[illegible] / J AFBSD APP DATE	K [illegible]

L REVISIONS: REVISION DATE (1)	CODE (2)	INITIATED BY (3)	AFBSD APPROVAL DATE (4)	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS (1)	FEDERAL ITEM ID NUMBER (2)	MANUFACTURER'S PART NUMBER (3)	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP (1)	LCF (2)	MLCC (3)	SMSB (4)	SRA (5)	MAMS (6)	(7)	(8)	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
[illegible]		Initial PDR	4/9/3																	GFE			W-6	2.57.51 [illegible]

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide a source of emergency electrical power to maintain critical loads to keep the missile and OGE in strategic Alert status for an emergency period and to perform a launch at any time during, or at the end of, this period. Specific loads to be supplied from the emergency power source are:

1. NCU's and TVCU
2. G&C Ground Electronics for Accelerometer Oil Heater
3. Emergency Environmental Control
4. GES Radio
5. G&C Ground Electronic equipment (Signal Data Converter Set and G&C Power Conversion Equipment)
6. GES equipment (UTAH, Voice & Data Terminal-MPCS, and Antenna Tuner)
7. Emergency G&C Cooling System
8. G&C Cooling Control
9. Ordnance Circuits
10. Security System

The emergency power source must supply power whenever there is a loss of primary power and must be capable of operating in an overt attack environment.

I. (Continued)

B. Design Constraints

1. Power

The Storage Battery, Launcher, shall function in accordance with AFBSD Exhibit 62-77, Paragraph 3.2.2 during charging and emergency power conditions to supply the loads in I.A., above, having characteristics defined in ICD's: Two batteries are required, one to serve items 1 thru 4 and the other to serve items 5 thru 10.

2. Physical

The design concept of the Storage Battery, Launcher, shall be identical to that of Figure A 1282, Revision G, Battery, Storage, Launcher, with modifications as to the number of parallel combinations of two series battery units to provide storage battery capacity for Wing VI equipment.

R 3. Interface

The Storage Batteries shall interface with Cable Assemblies defined by the Cable Assembly Set, Launcher, Figure A 1248.

The Storage Batteries shall interface with RPIE as defined by applicable FCD's.

4. Environment

The Storage Battery, Launcher shall function in nuclear shock and EMP environments defined in D2-30028-1, Paragraphs 2.1.3.2, and 2.2.4; and an ambient environment defined by D2-30028-1, Paragraph 2.1.2.2.A.

5. Weapons Effects

See Paragraph I.B.4, above

6. Monitoring

Not Applicable

7. Special Considerations

Not Applicable

I. TECHNICAL REQUIREMENTS (Continued)

C. Operability and Maintainability

The Storage Battery, Launcher, shall utilize the maintainability, concepts defined by D2-30028-1, Section 2.3.

D. Reliability

To be determined

E. Applicable Documents

1. D2-30028-1, "WS-133B Operational Ground Equipment Design Discipline Document-Contractual," Revision A, February, 1963.

2. D2-30028-2 "Structural Design Criteria-Operational Ground Equipment - Minuteman Wing VI," February, 1963.

3. AFBSD Exhibit 62-77, "Electric Power and Cabling Subsystem Criteria, WS-133B", Revision I, 25 October 1962.

II. RECOMMENDED SOLUTION

It is recommended that the Storage Battery, Launcher, shall consist of ten GFE, 533 ampere hour battery units (AF P/N BB46/GSW-4 Model Spec. No. S-133-III-1-10. Voltage characteristics will be obtained by arranging the units in groups of two, connected in series. Load requirements will be obtained by connecting the groups in parallel.

Battery No. 1, providing power to items 1 thru 4 of I, A. will consist of three parallel strings of two battery units each.

Battery No. 2, providing power to items 5 thru 10 of I, A will consist of two parallel strings of two battery units each.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 1294	F SWITCH, SENSITIVE SA-824/GSQ-54	G	12-31-62	KAF04(691)-2c6
			J AFBSD APP DATE 1-23-3	

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
	6A		1-23-3																	CFE			W-6	2.29 2.59

I. TECHNICAL REQUIREMENTS

A requirement exists to provide a device to detect displacement of the Launcher Closure Latch from its fully locked position to give an indication through the security monitoring system to the LCC operator. This device must be capable of being integrated into a self-test system loop. It should also have the capability of being integrated into a manual verification system loop.

II. RECOMMENDED SOLUTION

It is recommended that an electro-mechanical micro-switch be provided for the above requirement. The switch shall be installed in a location such that any movement of the closure latch will cause an inner zone security violation alarm. The device shall be a part of the Security System self-test and manual verification loops.

This Figure A is identical to Figure A 1294 Revision E.

SHEET 1 OF 1 NOMENCLATURE SWITCH, SENSITIVE SA-824/GSQ-54 FIGURE A NUMBER 1294

2-6836-0.3

TYPE OF LIST
A OPERATIONAL GROUND EQUIPMENT

MODEL DESIGNATION
B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION
C

CONTRACTOR
D THE BOEING COMPANY

FIGURE A NUMBER
E 1294

MILITARY NOMENCLATURE AND FED. MFR'S CODE
F SWITCH, SENSITIVE SA-824/GSQ-54

COMMON NOMENCLATURE
G

H ORIGINATION DATE 12-31-6?
J AFBSD APP DATE 1-23-3

CONTRACT NO.
K AF04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
	6A		1-23-?																	CFE			W-6	2.29 2.59

I. TECHNICAL REQUIREMENTS

A requirement exists to provide a device to detect displacement of the Launcher Closure Latch from its fully locked position to give an indication through the security monitoring system to the LCC operator. This device must be capable of being integrated into a self-test system loop. It should also have the capability of being integrated into a manual verification system loop.

II. RECOMMENDED SOLUTION

It is recommended that an electro-mechanical micro-switch be provided for the above requirement. The switch shall be installed in a location such that any movement of the closure latch will cause an inner zone security violation alarm. The device shall be a part of the Security System self-test and manual verification loops.

This Figure A is identical to Figure A 1294 Revision E.

SHEET 1 OF 1

NOMENCLATURE SWITCH, SENSITIVE SA-824/GSQ-54

FIGURE A NUMBER 1294

TYPE OF LIST
A OPERATIONAL GROUND EQUIPMENT

MODEL DESIGNATION
B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION
C ENVIRONMENT

CONTRACTOR
D THE BOEING COMPANY

FIGURE A NUMBER
E 1316

MILITARY NOMENCLATURE AND FED. MFR'S CODE
F PLUMBING SET, GUIDANCE AND CONTROL GROUND COOLING

COMMON NOMENCLATURE
G

H ORIGINATION DATE 12/3/2

J AFBSD APP DATE 1-17-3

CONTRACT NO.
K AF04(694)-

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
	6A		1-17-3																					
4	A	In-House																						
3-6-3	6A	PDR	3-6-3																	CFE			W-	2.- 2.-.4.3 2.-.4.3 2.-.4.4

I. TECHNICAL REQUIREMENTS

A requirement exists to transfer conditioned coolant, 0.2% sodium chromate (by weight) highly purified water from the storage tanks (Fig. A 1317) to the Cooling Unit (Fig. A 1214), to the G&C Compartment umbilical (Fig. A 1248), and back to the storage tank. The transfer equipment must satisfy the following conditions:

A. Provide a means to prevent corrosion in the entire cooling system.

. A resistance between the missile and the ground through the coolant* must be maintained to 0.1 megohm minimum.

C. Warm coolant returning from the G&C compartment must not mix with the chilled supply coolant during the 6 hour emergency period.

II. RECOMMENDED SOLUTION

It is recommended the following equipment be provided to accomplish the above requirements:

1. Flexible, neoprene lined tubing from the tanks described in Figure A 1317 to the cooling unit described in Figure A 1214 to the G&C umbilical connection (part of Figure A 1248*) and return.

R 2. A 37.7 to 28 v DC* normally open, solenoid valve and plumbing mounted between the tanks described in Figure A 1317. In the emergency condition this valve will keep separate the chilled coolant and the warm coolant flowing from the G&C compartment. The valve will be actuated upon loss of AC power at the G&C Compartment Cooling Unit (Figure A 1214).

SHEET ____ OF 4

NOMENCLATURE PLUMBING SET, GUIDANCE AND CONTROL, GROUND COOLING FIGURE A NUMBER 1316

2-6834-0-5

REV SYM B

II. **RECOMMENDED SOLUTION** (Continued)

3. To reduce corrosion of the magnesium heat exchanger in the G&C Compartment and to maintain a minimum 0.1 megohm resistance between the missile and ground, through the coolant* a corrosion inhibitor compound consisting of 0.2% sodium chromate (by weight) will be added to highly purified * water. This combination will be used as the coolant fluid.

This Figure A is identical to Figure A 1318, Revision F except where noted by an*.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 1322	F SUPPORT, MISSILE SUSPENSION AND ALIGNMENT SYSTEM	G	12/3/2	K AF04(694)-2[illegible]
			J AFBSD APP DATE 1-17-3	

L REVISIONS: Revision Date 1	Code 2	Initiated By 3	AFBSD Approval Date 4	M Functional Class Index	N Stock Number: Fed. Supply Class 1	Federal Item ID Number 2	Manufacturer's Part Number 3	P Basis of Issue and Quota Allocations: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod. Lead Time	X End Item Effectivity	Y Remarks
[illegible]	CA	In-House	1-17-3																					
4/30/3	CA	PDR	5/[illegible]																	CFE			W-6	2.5b 2.5a.3.20 2.5a.3.24

L

TECHNICAL REQUIREMENTS

A requirement exists for:

A. A means to support the missile concentrically and level within the launch tube.

B. A support and suspension system which will attenuate nuclear shocks which fall within design criteria to accelerations within stability and structural limits of the missile.

R *C. A missile azimuth drive which will rotate the missile relative to the launch tube within accuracies required for missile emplacement, removal and targeting.

D. A base support clamp system which will provide a means of holding the Missile Base Adapter Ring (Fig. A 1252) to a receiver ring during launch.

*E. A tether system which will arrest mount motion during lift-off to insure missile clearance with the mount structure.

F. A means to electrically ground the system to prevent the accumulation of static electricity.

G. A means to relevel the tethered missile base support for receiving a new missile, after removal of a missile for recycle.

R *H. A means to suspend the missile at the proper elevation must be provided in accordance with Paragraph 3.3.2 AFBSD 62-123 Dated Jan. 1963.

II. RECOMMENDED SOLUTION

It is recommended that a parallel link-pendulum, spring-mounted suspension system be provided to satisfy the above requirements. The system consists of a receiver ring, base ring, suspension springs, torsion bars, azimuth drive system, and a leveling mechanism. The receiver ring is equipped with alignment ears to guide the missile concentrically to the mount during emplacement. This receiver ring is mounted on a thrust bearing supported by a base ring and can rotate relative to the base ring on the thrust bearing. The base ring is suspended from three parallel cables connected, over sheaves, to suspension springs.

R * A mechanical device consistent with human factors requirements will be provided for manual rotation of the receiver ring relative to the base ring to provide missile azimuth positioning. Leveling is accomplished via a leveling mechanism at the lower end of each suspension spring The suspension cable can be lengthened

R or shortened to obtain the desired missile base leveling. *Positioning the mount at the proper elevation is accomplished by adjustement provided at the cable tie-rod fitting and the leveling mechanism. A set of base support clamps is spaced around the receiver ring as necessary to enable the receiver ring to securely hold the missile base adapter ring during launch. Three tether cables connect the base ring to tether springs at the bottom of the launcher to arrest mount motion during lift-off to insure missile clearance with the mount structure. A stud hole is provided in the base ring for attachment of ground strap provisions for electrically grounding the system to prevent the accumulation of static electricity.

This Figure A is similar to Figure A 1322.2, Revision "BASIC" except as noted by an (*).

TYPE OF LIST (A)	MODEL DESIGNATION (B)	SUB SYSTEM IDENTIFICATION (C)	CONTRACTOR (D)
OPERATIONAL GROUND EQUIPMENT	SM-80 WEAPON SYSTEM	POWER	THE BOEING COMPANY

FIGURE A NUMBER (E)	MILITARY NOMENCLATURE AND FED. MFR'S CODE (F)	COMMON NOMENCLATURE (G)	H ORIGINATION DATE	J AFBSD APP DATE	CONTRACT NO. (K)
1337	DISTRIBUTION BOX, LAUNCHER		12/3/2	3/6/3	AF04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
	6A																							
2/ 5/ [illegible]	6A	In-House																						
[illegible]	6A	PDR	3/6/3																	CFE			W-6	2.28.4.3 2.26.5 2.57.52 2.57.53 2.57.54 2.57.55 2.57.56 2.57.57 2.57.60 2.57.61 2.57.62 2.57.63 2.57.64 2.57.65 2.57.66 2.72.3.2 3.39.3.3 3.39.3.4

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

1. A requirement exists to provide a means to distribute electrical power and signals between RPIE and OGE, OGE and OGE, and OGE and the missile during the normal and emergency modes of operation.

2. A requirement exists to provide a means to control the electrical power to the NCU's and TVCU by a remote signal from the G&C signal converter set.

3. A requirement exists to provide a remotely actuated Safety Control Switch with manual over-ride to interrupt the following critical ordnances:

R

a. Safe and Arm Device activation
b. G&C Umbilical Deadface
c. G&C Umbilical Release
d. Upstage Battery Activation
e. Downstage Battery Activation
f. G&C Umbilical Retraction
g. Silo Cover Removal
h. First Stage ignition

R

Test loads for the above circuits shall be provided.

B. Design Constraints

1. Power

R

a. Safety Control Switch

(1). The motor of the safety control switch shall operate on a maximum of 3 amperes at 24 to 37 volts DC within 0.5 seconds.

I. (Continued)

R (2). The ordnance contacts shall carry a 10 ampere resistive load at 38 volts DC for 30 seconds and a 36 ampere resistive load at 38 volts DC for 2 seconds.

(3). The SCS status monitor circuit contacts shall be capable of carrying and interrupting 50 milliamperes at 10 volts DC.

b. NCU Power Contactors

(1). The NCU/TVCU power contactors shall operate on a maximum of 1 ampere at 32 volts DC.

(2). The contacts shall be capable of functioning as follows:

Continuously carry and interrupt 120 amperes at 28 to 37.7 volts DC

Withstand a transient inrush current of 1100 amperes at 28 to 37.7 volts DC upon contact closing

R Withstand pulses totaling 320 amperes at 28 to 37.7 volts DC.

2. Physical

The design concept of this equipment shall be similar to that of Figure A 1337.3, Rev. A, Distribution Box, with modifications to provide interface compatibility with Wing VI equipment and deletion of the following:

a. S&A Module
b. Circuit breakers and control relays, except as required by Functional requirements specified in Paragraphs I.A.2 & 3, above.

3. Interface

The Distribution Box, Launcher, shall interface with Cable Assemblies defined by the Cable Assembly Set, Launcher, Figure A 1248, and the following ICD's:

R ICD 25-38225 "Voice, Data and Message Processing Equip. & C163 Converter Signal Data-Electrical"
ICD 25-38229 "C225 Power Converter-Electrical & Cooling"
R ICD 25-26451 "C21 Collimator Set-Electrical"
ICD 25-26402 "G&C Umbilical Connector-Electrical & Cooling"
ICD 25-26430 "Pullaway Umbilical Connector-Electrical"

I. (Continued)

R Additional interface documents will define the following areas:

Security Subsystem
Environmental Control System

R The Distribution Box, Launcher, shall interface with RPIE as defined by applicable PCD's.

4. Environment

The Distribution Box, Launcher, shall function in nuclear shock and EMP environments defined by D2-30028-1, Paragraph 2.1.3.2 and 2.2.4, and an ambient environment defined by D2-30028-1 Paragraphs 2.1.2.2A.

5. Weapon Effects

See Paragraph I.B.4 above.

6. Monitoring

a. The position of the Safety Control Switch shall be monitored.
R b. Means shall be provided for monitoring NCU power application.

7. Special Considerations

a. Finish and marking shall conform to the requirements of AFBSD Exhibit 62-88.
b. The Distribution Box, Launcher, shall conform with electrostatic and electromagnetic interference suppression requirements of AFBSD Exhibit 62-87, Paragraph 3.2.1 thru 3.2.7 and 3.2.9.2 thru 3.2.9.4.
c. The Safety Control Switch will be remotely controlled by signals from the Data Signal Converter.
d. The Safety Control Switch shall be a motor-driven, multi-contact switch assembly. The motor shall be bi-directional, providing capability for either opening, or closing the required contacts. There shall be provisions for external manual safing, local visual indications of switch positions, provisions for remote electrical monitoring of safe and arm positions, and capability for locking R in the "Safe" position by maintenance personnel. The Safety Control Switch shall be similar to the Safety Control Switch utilized in Figure A 1337.3, Revision A, with the following modifications:
   (1) Contacts shall be provided in both the positive and negative lines of each circuit.
   (2) Insertion of the manual locking device shall disconnect the input circuit of the "Arm" coil.
   (3) The manual locking device shall be prevented from being removed if an "Arm" signal is present. If pin removal is attempted with an "Arm" signal present, the monitor contact R shall leave the "Safe" position but not travel to the "Arm" position.

I. (Continued)

e. The NCU relays shall be remotely controlled by a signal from the G&C Power Conversion Set.
f. The NCU relays shall be similar to those used in Figure A 1337.3, Revision A. Specific requirements will be defined in the ICD.
g. Human Engineering shall be in accordance with D2-30028-1, Section 2.4.

C. Operability and Maintainability

The Distribution Box, Launcher, shall utilise the maintainability, concepts defined by D2-30028-1, Section 2.3.

D. Reliability

To be determined

E. Applicable Documents

1. D2-30028-1, "WS-133B Operational Ground Equipment Design Discipline Document-Contractual", Revision A, February, 1963.
2. D2-30028-2, "Structural Design Criteria-Operational Ground Equipment-Minuteman Wing VI", February, 1963.
3. AFBSD Exhibit 62-87, "Electro-Interference Control Requirements for Minuteman", 6 December 1962.
4. AFBSD Exhibit 62-88, " Finish Criteria, WS-133B", 11 June 1962.

II. RECOMMENDED SOLUTION

It is recommended that a distribution box be provided which will facilitate connecting the cables from OGE to the missile and to function as a distribution medium for electrical power and signals between RPIE and OGE, OGE and OGE, and OGE and the missile during the normal and emergency modes of operation.

R Remotely controlled contactors, used to control the power from Battery Set #1 (Figure A 1282) to the First Stage NCU and to the Second Stage TVCU and Third Stage NCU, shall be included in this distribution box. A time delay of a nominal 225 milli-seconds shall be provided between starting the First Stage NCU and starting the Second Stage TVCU and Third Stage NCU.

A remotely actuated Safety Control Switch with manual over-ride shall be included in this distribution box. The Safety Control Switch will be used to interrupt the following critical ordnance circuits:

II. (Continued)

Safe & Arm Device activation
G&C Umbilical Deadface
G&C Umbilical Release
G&C Umbilical Retraction
R Upstage Battery Activation
Downstage Battery Activation
Silo Cover removal
First Stage ignition

R Test loads for the above circuits shall be provided.

The Distribution Box will be a welded metal frame box approximately 65 1/2 inches high, by 36 inches wide, by 12 inches deep enclosed with sheet metal paneling. The Distribution Box shall utilize materials and assembly procedures which will fulfill the technical requirements of Section I, above. It will be composed of:

Multi-pin connectors with crimp-type removable pins, as required
Wire harnesses for internal interconnections, as required
Cabinet ground lug terminal
Safety Control Switch
NCU and TVCU power contactors and time-delay relay

A. TYPE OF LIST	B. MODEL DESIGNATION	C. SUB SYSTEM IDENTIFICATION	D. CONTRACTOR
OPERATIONAL GROUND EQUIPMENT	SM-80 WEAPON SYSTEM	ENVIRONMENT	THE BOEING COMPANY

E. FIGURE A NUMBER	F. MILITARY NOMENCLATURE AND FED. MFR'S CODE	G. COMMON NOMENCLATURE	H. ORIGINATION DATE	J. AFBSD APP DATE	K. CONTRACT NO.
1375	DAMPER SET, FLUE-ELECTRONIC COOLING		12/3/2	1-17-3	AF04(694)-260

L. REVISIONS: REVISION DATE (1)	CODE (2)	INITIATED BY (3)	AFBSD APPROVAL DATE (4)	M. FUNCTIONAL CLASS INDEX	N. STOCK NUMBER: FED. SUPPLY CLASS (1)	FEDERAL ITEM ID NUMBER (2)	MANUFACTURER'S PART NUMBER (3)	P. BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF (1)	LCF (2)	MLCC (3)	SMSB (4)	SRA (5)	MAMS (6)	(7)	(8)	Q. TOTAL ON ORDER	R. ESTIMATED UNIT PRICE	S. ESTIMATED TOTAL PRICE	T. COGN. LAB CENTER & SERVICE	U. PROPOSED SOURCE OF SUPPLY	V. SOURCE CODE	W. EST. PROD. LEAD TIME	X. END ITEM EFFECTIVITY	Y. REMARKS
	6A		1-17-3																	CFE			W-6	2.53 2.58

I. TECHNICAL REQUIREMENTS

A requirement exists to provide a means of controlling the volume of cooling air to each equipment cabinet requiring cooling in the Launcher Control Centers and Launchers. The control shall range from full open to full closed and shall have a graduated indicator to show the control position. A positive locking device shall be provided to lock the control in the adjusted position. The locking device shall include a tamper resistance feature and a "Do Not Tamper" decal.

II. RECOMMENDED SOLUTION

A. A damper shall be provided for installation in the cooling air duct, a 6 inch flex hose connected to Figure A's 1211 and 1212 and going to the following racks:

Rack	LCC No. of Dampers	Launcher No. of Dampers	Fig. A No.

*List to be added at later date.

SHEET 1 OF 2 NOMENCLATURE DAMPER SET, FLUE-ELECTRONIC COOLING FIGURE A NUMBER 1375

II. RECOMMENDED SOLUTION (Continued)

B. The damper shall be designed to operate in air with a static pressure of 1.5 inches of water. It shall be constructed of sheet metal pipe, nominal diameter of six inches, with a butterfly damper having a graduated indicator on the outside of the pipe. The indicator shall have a positive locking device allowing it to be locked in any position from full open to full closed. The positive lock shall have a safety wire to prevent tampering and a "Do Not Tamper" decal shall be placed by the indicator. All ferrous metals shall be treated for corrosion resistance. The lower connection shall be suitable for attachment to the equipment frame air transition ducts and the upper connection shall be suitable for joining with a 6 inch round flexible duct.

NOTE: This Figure A is Identical to Figure A 1375 Revision C except where noted by an *.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO.
E 1418	F VALVE, BLAST, 24", LCEB	G	12/3/2 / 1/23/?	K AF04(694)-2??

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-1?-??	??	I-1?? PDR	1-23-?																	CFE			W-6	
4-3-?	6A	PDR	4-3-?																					2.53 2.53.2.12 2.53.2.15 2.53.2.2? 2.53.2.22 2.53.2.23 2.53.2.21

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

Automatic closing of ventilation air openings must be provided to protect LCC personnel and equipment, and LCEB equipment from harmful overpressures.

1. The Blast Valves shall allow air flow at a minimum of 5000 CFM@ Sea Level pressure and 55°F with a maximum pressure drop of 1.00 inches water gauge for use by the Ventilation System, LCEB and Environmental Control System, LCC.

2. The Blast Valves shall remain closed until opened by the Blast Valve Control System (Fig. A 1432) and shall not be opened by ground accelerations or negative pressures.

3. The Blast Valves shall have a means of indicating their position status to the Blast Valve Control System (Fig. A 1432).

4. The Blast Valves will be compatible with the Blast Valve Control System (Fig. A 1432).

SHEET 1 OF 4 NOMENCLATURE VALVE, BLAST, 24", LCEB FIGURE A NUMBER 1418

2-4834-0-5

I. TECHNICAL REQUIREMENTS (Continued)

5. The Blast Valves shall have a means of indicating opening and closing to the Blast Valve Control System (Fig. A 1432), so that Diesel Generator start-up and shutdown can be initiated

R 6. The absolute value of the pressure pulse on the downstream side of the valve due to pumping action, leakage, etc. shall not exceed neither an impulse of 40 psig - milliseconds nor a peak pressure of 2 psig.

7. Blast Valves shall be able to operate 5 times after AC power is lost

R 8. Provision to implement automatic reopening of the blast valve ~~after initial~~ closure by overpressure pulse ~~or after any successive overpressure~~ pulse while the blast valve is closed.

B. Design Constraints

1. Power

a) Electrical

1. The electrical power needs shall be compatible with Figure A 1432 and Diesel Generator Starting Battery.

2. Physical

Physical constraints shall be in accordance with the structural considerations described in D2-30028-2, Section 14.0

3. Interface

a) Physical

1. Blast Valves will interface with the wall inserts in the LCEB.

b) Electrical & Hydraulic

1. Blast Valve system components will interface with the electrical and hydraulic systems of the Blast Valve Control System (Figure A 1432) and Diesel Generator Starting Battery.

I. <u>TECHNICAL REQUIREMENTS</u> (Continued)

B. Design Constraints (Cont'd.)

1. Environmental

a) Ambient

1. Temperature - operating: -40° F to $+250^{\circ}$
2. Humidity - operating: Not to exceed 700 grains of moisture per one (1) pound of air at operating temperature when Diesel Generator is operating
3. Pressure - operating and storage: Sea level to 7,000 ft
4. Sand and Dust: As specified by Procedure I, Mil-E-4970A, except maximum temperature not to exceed $+150^{\circ}$ F and velocity equal to 5000 SCFM
5. Temperature - Shipping and Storage: -65°F to $+150^{\circ}$F
6. Humidity, Shipping and Storage: 0-95% Relative Humidity at Shipping and Storage temperatures
7. Pressure - Altitude, Transportation: Sea level to 30,000 ft.
8. Fungus: No fungus nutrient materials shall be used in components or finishes
9. Corrosion Resistance: The blast valves shall withstand the corrosive effects of the exhaust fumes from the diesel engine of the standby generator and environmental control system exhaust.

b) Dynamic

In accordance with Paragraph 14.1.2 of D2-30028-2

5. Weapons Effects

In accordance with Paragraph 14.1 of D2-30028-2

6. Monitoring

a) Monitoring of the Blast Valve opened and closed positions shall be provided to the Blast Valve Control System (Figure A 1432).

b) A quantitative indication of hydraulic and nitrogen accumulator pressure must be displayed on the Blast Valve Control System (Fig. A 1432).

7. Special Considerations

a) Finish and marking shall conform to the requirements defined in AFBSD Exhibit 62-88.

I TECHNICAL REQUIREMENTS (Continued)

A. Special Considerations (Cont'd.)

b) Human Engineering considerations shall conform to the concepts of Section 2.4 of D2-30028-1.

c) Electrical Interference considerations shall conform to paragraphs 3.2.1 thru 3.2.7 and 3.2.9.2 thru 3.2.9.4 of AFBSD Exhibit 62-87.

C Operability and Maintainability

In accordance with D2-30028-1, Section 2.3, the valve shall have a maintenance free life of 3 years and a usefull life of 10 years.

D Reliability

The reliability design objective assigned to this system is /cycle and the MCBF is

E Applicable Documents

D2-30028-1, "Operational Ground Equipment Design Discipline Document" dated February 1963
D2-30028-2, "Structural Design Criteria - Operational Ground Equipment - Minuteman Wing VI, dated February 1963.
AFBSD Exhibit 62-88, Finish Criteria WS-133B, 11 June 1962
AFBSD Exhibit 62-77, Electric Power and Cabling Subsystem Criteria Revision 1, 25 October 1962
AFBSD Exhibit 62-87, "Electro - Interference Control requirements for Minuteman", dated 6 December 1962.

II. RECOMMENDED SOLUTION

It is recommended that the design configuration for the Valve, Blast, 24", Figure A 1418.3, Revision Basic, be used to meet the technical requirements in IA above. This design will be used with changes limited to those required to meet the following Wing VI conditions:

1. Control (in connection with Blast Valve Control System Fig. A 1432 Revision 6A)
2. Environmental (Due to new valve location and new environmental Control System Criteria)
3. Valve leakage (Due to new location and useage)
4. Interfaces (Due to new location and new blast valve control requirements)

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	J AFBSD APP DATE	CONTRACT NO.
E 1421	F SHOCK ISOLATOR SET, SHOCK ATTENUATION	G	1/23/3	2-?/3	K AF [illegible]

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
[illegible]	A A	b-Fuse PDR	2-?-3																	CFE			W-6	2.[illegible] 2.53.2.4 2.5[illegible]

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to support and protect the following weapon system equipment, located in the launch control center, from seismic and nuclear blast shock effects, per Para. IB5. The shock attenuation system shall attenuate ground shock inputs to the levels stated in Para. IB7a and the motion shall be dampened as specified in Para. IB7a.4.

Equipment	Shape Factor	Mass C. G. *Location x	y	z	Estimated Weight	Upper & Lower Bounds on Weight w/90% Confidence Level

SHEET 1 OF 4 NOMENCLATURE SHOCK ISOLATOR SET, SHOCK ATTENUATION FIGURE A NUMBER 1421

2-68340-5

Equipment	Shape Factor	Mass C.G.* Location x	y	z	Estimated Weight	Upper & Lower Bound on Weight w/90% Confidence Level

*with respect to geometrical center

SHEET 2 OF 4 NOMENCLATURE SHOCK ISOLATOR SET, SHOCK ATTENUATION FIGURE A NUMBER 1121

2-68340-6

I TECHNICAL REQUIREMENTS

B. Design Constraints

1. Power

Not Applicable

2. Physical

a) The floor configuration is as shown in Figure 7-1 of D2-30082, first approved issue.

b) The floor shall be supported vertically by isolators.

c) Constraints shall be put upon the facility contractor to locate the mass C.G. (equipment and floor structure) at the geometrical center with acceptable tolerances.

3. Interface

The Shock Isolator Set, Shock Attenuation, shall interface with the following RFIE:

a) Launch Control Center Structure

b) Structural Floor Unit

4. Environmental

Except as noted herein, the design and test requirements pertaining to AGE/OGE in D2-30028-1, Paragraphs 2.1.2.2D and 2.1.2.1 are applicable.

5. Weapons Effects

The Paragraphs referenced for the following conditions are found in D2-30028-2

a) Magnitude and sequence of attacks - see Paragraph 8.1.1

b) Ground Shock - see Paragraph 8.1.2

6. Monitoring

Not Applicable

7. Special Considerations

a) The paragraphs referenced for the following conditions are found in D2-30028-2

1) The Shock Isolators shall attenuate the ground shock defined in IB5 above to the levels defined in Paragraph 8.4.1.
2) Rattle Space - see Paragraph 8.4.2
3) Permanent Displacement - see Paragraph 8.4.3
4) Damping time - see Paragraph 8.4.4
5) For phasing between horizontal and vertical Ground Shock- see Paragraph 8.2.

b) Structural components shall conform to the requirements of Section 8.5 and 8.6 and Section 2.0 except Para. 2.3, 2.4, 2.5 of D2-30028-2

c) Finish and Marking shall conform to AFBSD Exhibit 62-88.

d) Human Engineering considerations shall conform to the concepts of Section 2.4 of D2-30028-1

C. Operability and Maintainability

The equipment shall be operable in accordance with Paragraph 2.1.2.D of D2-30028-1. The equipment shall be designed for a minimum amount of maintenance in accordance with section 2.3 of D2-30028-1. The equipment shall have a useful life of 10 years.

D. Reliability

The reliability design objective assigned to this system is cycle and the MCBF is

E. Applicable Documents

1) D2-30028-1, WS-133 Operational Ground Equipment Design Discipline Document, dated February, 1963.
2) D2-30028-2, Structural Design Criteria- Operational Ground Equipment - Minuteman Wing VI dated February, 1963.
3) D2-30082, Facility Criteria Document, WS-133B Launch Control Facility, dated
4) AFBSD Exhibit 62-88, Finish Criteria WS-133B, dated 11 June 62.

II. RECOMMENDED SOLUTION

It is recommended that a shock attenuation system utilizing four pneumatic shock isolator units identical in design approach to Figure A 1421.2 Rev A be provided. The isolators will be attached to the structural floor unit near the corners to suspend the floor in pendulum fashion from connections embedded in the Launch Control Center structure. Each shock isolator is comprised of a pneumatic cylinder and piston, a spring to provide a balancing force required to achieve equilibrium in the system in the normal (neutral) position, an air pressure tank built around the cylinder, a compressed air supply, control system, valves and accessory equipment.

TYPE OF LIST A: OPERATIONAL GROUND EQUIPMENT	MODEL DESIGNATION B: SM-80 WEAPON SYSTEM	SUB SYSTEM IDENTIFICATION C: ENVIRONMENT	CONTRACTOR D: THE BOEING COMPANY
FIGURE A NUMBER E: 1432	MILITARY NOMENCLATURE AND FED. MFR'S CODE F: CONTROL SYSTEM, BLAST VALVE	COMMON NOMENCLATURE G:	H ORIGINATION DATE 12/30; J AFBSD APP DATE 1/23/3; CONTRACT NO K: AF04(694)-266

REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4
	6A		1-23-
2/15/	A	In-house	
/5/	A	PDR	
4/12/	A	PDR	4-11-

M FUNCTIONAL CLASS INDEX; N STOCK NUMBER (FED. SUPPLY CLASS 1, FEDERAL ITEM ID NUMBER 2, MANUFACTURER'S PART NUMBER 3); P BASIS OF ISSUE AND QUOTA ALLOCATIONS (LF 1, LCF 2, MLCC 3, SMSB 4, SRA 5, MAMS 6, 7, 8); Q TOTAL ON ORDER; R ESTIMATED UNIT PRICE; S ESTIMATED TOTAL PRICE; T COGN. LAB CENTER & SERVICE; U PROPOSED SOURCE OF SUPPLY: CFE; V SOURCE CODE; W EST. PROD. LEAD TIME; X END ITEM EFFECTIVITY: W-6; Y REMARKS

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

R A system is required at the LCF and LF to control the operation of the 24" Blast Valves in the LCEB and the 36" Blast Valves in the LEB.

1. Hydraulic power must be provided to open the Blast Valve.
2. Hydraulic power must be capable of opening Blast Valves 5 times after loss of AC power.
3. Automatic opening of the Blast Valve must be provided after a time delay following the last overpressure received. Time delay shall be implemented by a timer capable of being adjusted to provided any selected time delay between 0 and 120 minutes. Over-all inaccuracies of the timer shall not exceed 10 percent of the elapsed time.
4. The Control to open the Blast Valve shall be powered by the Diesel Generator starting battery.
5. The system shall shut down the Diesel Generator, if operating, whenever Blast Valves start to close.
6. The system shall restart the Diesel Generator, if commercial power is out, whenever Blast Valves are fully open.
7. R The control system must be compatible with the Blast Valves, LCEB Figure A 1418 and LEB Figure A 5000.
8. R Necessary plumbing and cabling, including fittings to connect the Control System to the LCEB Blast Valve (Figure A 1418) or LEB Blast VAlve (Figure A 5000) shall be provided.
9. Hand power operation of the Blast Valve shall be provided for Maintenance (opening and closing).

REMARKS:
2.53
2.53.2.15
2.53.2.20
2.53.2.21
2.53.2.22
2.53.2.23
R 2.59.3.3
2.58.3.22
R 2.58.3.23

SHEET 1 OF 5 NOMENCLATURE CONTROL SYSTEM, BLAST VALVE FIGURE A NUMBER 1432

2-68340-5

I. TECHNICAL REQUIREMENTS (Continued)

B. Design Constraints

1. Power

a. Electrical

1. The electrical power needs shall be compatible with the power available as defined in AFBSD Exhibit 62-77 except the deviation defined in paragraph 2.2.3 of D2-30028-1. The power needs shall be compatible with the Diesel Generator Starting battery for initiating the opening of the Blast Valve.

2. Physical

Design concept shall be similar to that of the Control System, Blast Valve, Figure A 1832.3 Revision-Basic, for LCEB Blast Valve Control. Modification will be limited to those changes necessary to meeting Wing VI requirements.

3. Interfacing

R a. Physical

1. System components will interface with LCEB or LEB shock isolation equipment, RPIE, and the LCEB or LEB Structure.

2. Control System components will interface with Blast Valve actuation and sensing components.

R b. Electrical

1. Control System components will interface with electrical components used in conjunction with Blast Valves LCEB, Figure A 1418 and Blast Valves LEB, Figure A 5000.
2. Electrical power used for system operation will interface with commercial and standby power system defined in AFBSD Exhibit 62-77, except for deviation defined in paragraph 2.2.3 of D2-30028-1.
3. Power for control components needed to initate Blast Valve operation must interface with Diesel Generator starting batteries.

I. TECHNICAL REQUIREMENTS (Continued)

B. Design Constraints

4. Environment

a. ambient

In accordance with D2-30028-1, Paragraph 2.1.2.2C

b. dynamic

In accordance with D2-30028-2, Paragraph 9.1

5. Weapons Effects

See IB4 above

6. Monitoring

R In the LCEB and LEB display the following:

1. Blast Valve position status
2. Hydraulic and Nitrogen pressures in the accumulator

7. Special Considerations

a. Finish and marking shall conform to the requirements defined in AFBSD Exhibit 62-88.
b. Human Engineering considerations shall conform to the concepts of Section 2.4 of D2-30028-1
c. Electrical Interference considerations shall conform to paragraphs 3.2.1, thru 3.2.7 and 3.2.9.2 thru 3.2.9.4 of AFBSD Exhibit 62-87.

I. TECHNICAL REQUIREMENTS (Continued)

C. Operability and Maintainability

For these considerations refer to D2-30028-1 section 2.3. The control system shall have a maintenance free life of 3 years and a useful life of 10 years.

D. Reliability

The reliability design objective assigned to this system is hours MTBF.

E. Applicable Documents

D2-30028-1 WS-133B Operational Ground Equipment Design Discipline Document Contractual

D2-30028-2 "Structural Design Criteria-Operational Ground Equipment, - Minuteman Wing VI
AFBSD Exhibit 62-88 Finish Criteria WS-133B Dated 11 June 1962
AFBSD Exhibit 62-77 Electric Power and Cabling Subsystem Criteria Revision I, 25 October 1962
AFBSD Exhibit 62-87 "Electro-Interference Control Requirements for Minuteman," Dated 6 December 1962

II. RECOMMENDED SOLUTION

R It is recommended that a control system capable of meeting the Functional Requirements in Paragraph IA above be provided to control and furnish power for actuation of the LCEB Blast Valves, and LEB Blast Valves.

A. The control system shall be made up of the following Units and components:

1. Hydraulic Power Unit containing:

a. 208V, three phase, 60 cycle AC motor & starter
b. Hydraulic pump
c. Reservoir
d. Floating piston type hydro-pneumatic accumulator
e. Nitrogen receiver
f. Necessary Valves and fittings

II. RECOMMENDED SOLUTION (Continued)

2. Hydraulic Control Unit containing:

R a. Hand pump for manual operation of the 24" Blast Valves or 36" Blast Valves.
b. Valves and fittings as required.
R c. Pressure gauges to indicate nitrogen and hydraulic pressure in the LCEB or LEB. accumulator and hydraulic pressure in the hand pump discharge line.
R d. Indicating lights to indicate the open and closed positions of the 24" Blast Valves or 36" Blast Valves.

3. Electrical Control Unit containing:

a. Wiring, switches and relays as required, to provide the necessary internal circuits needed for the following control system operations:

1. Automatic opening of blast valves
2. Maintenance opening and closing of blast valves
3. Diesel generator start and stop

b. A timer shall be used to provide a time delay in the reopening of the blast valves. The timer shall be adjustable from 0 to 120 minutes.

R B. The control system will be installed on the LCEB or LEB shock isolated floor and will be designed to withstand the shock environment at this installed location.

C. The control system will be a single package made up of the units and components mentioned in IIA above and containing the hydraulic inter-connections needed to connect the system to the blast valves.

D. The control system will be compatible with the following:

1. Blast Valve, 24", LCEB (Fig. A 1418)
2. Adapter Kit (Cylinder Valve Assembly, compressed Gas) Figure A 4570.
R 3. Blast Valve LEB (Figure A 5000).

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO
E 5.00	F VALVE, BLAST, LEB	G	12/3/2	K AF 04(694)-266
			J AFBSD APP DATE 4-33	

L REVISIONS: REVISION DATE 1	2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2/5/3 3/23 4/3/3	6 6A 6	In-Line PDR PDR	4-3-3																	CFE			W-6	2.58.3.2 2.58.3.3 2.58.3.22 2.58.3.23

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

Automatic closing of ventilation openings must be provided to protect LEB equipment from harmful overpressures.

1. The Blast Valves shall allow air flow at a minimum of 12,000 SCFM and a maximum pressure drop of 1.00 inches water gauge for use by the Ventilating System, LEB and Environmental Control System, LF.

R 2. The Blast Valves shall remain closed until opened by the Blast Valve Control System (Figure A 1432) and shall not be opened by ground accelerations or negative pressures.

3. The Blast Valves will be compatible with the Blast Valve Control System (Figure A 1432).

R 4. The Blast Valves shall have a means of indicating opening and closing to the Blast Valve Control System (Figure A 1432) so that Diesel Generator startup and Shutdown can be initiated.

5. The absolute value of the pressure pulse on the down stream side of the valve due to pumping action, leakage, etc. shall not exceed neither an impulse of 40 psig millisecond nor a peak pressure of 1 psig.

6. Blast Valves shall be able to operate 5 times after AC power is lost.

7. Provision to implement automatic reopening of the Blast Valve after initial closure by overpressures or after and successive overpressure pulse.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	J AFBSD APP DATE	CONTRACT NO
E 5200	F VALVE, BLAST, LEB	G	12/3/2	4-33	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2/15/? 9/?? 4/3/?	6 ?? ?A ??	In-House PDR PDR	4-3-3																	CFE			W-6	2.58.3.2 2.58.3.3 2.58.3.22 2.58.3.23

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

Automatic closing of ventilation openings must be provided to protect LEB equipment from harmful overpressures.

1. The Blast Valves shall allow air flow at a minimum of 12,000 SCFM and a maximum pressure drop of 1.00 inches water gauge for use by the Ventilating System, LEB and Environmental Control System, LF.

R 2. The Blast Valves shall remain closed until opened by the Blast Valve Control System (Figure A 1432) and shall not be opened by ground accelerations or negative pressures.

3. The Blast Valves will be compatible with the Blast Valve Control System (Figure A 1432).

R 4. The Blast Valves shall have a means of indicating opening and closing to the Blast Valve Control System (Figure A 1432) so that Diesel Generator startup and Shutdown can be initiated.

5. The absolute value of the pressure pulse on the down stream side of the valve due to pumping action, leakage, etc. shall not exceed neither an impulse of 40 psig millisecond nor a peak pressure of 1 psig.

6. Blast Valves shall be able to operate 5 times after AC power is lost.

7. Provision to implement automatic reopening of the Blast Valve after initial closure by overpressures or after and successive overpressure pulse.

I. TECHNICAL REQUIREMENTS (Continued)

R 8. The Blast Valves shall have a means of indicating their position status to the Blast Valve Control System (Figure A 1432).

B. Design Constraints

1. Power

a. Electrical

The electrical power needs shall be compatible with available commercial and standby power as defined in AFBSD Exhibit 62-77.

2. Physical

Design concept shall be identical to that of the Blast Valves, LCEB, Figure A 1428.3 Revision-Basic, except where revisions are needed to meet Wing VI requirements.

3. Interface

a. Physical

1. Blast Valves will interface with the wall inserts in the LEB

2. Hydraulic and electrical components used for Blast Valve actuation and control will interface with LEB shock isolation equipment and RPIE.

b. Electrical

R 1. Blast valve system components will interface with the electrical systems used in conjunction with the Blast Valve Control System (Figure A 1432) and the Diesel Generator starting battery.

2. Electrical power used for system operation will interface with commercial and standby power distribution systems.

4. Environmental

a. Ambient

1. Temperature - Operating: -40 deg. F to +250 deg. F

R 2. Humidity - Operating: Not to exceed 195 grains of moisture per one (1) pound of air at operating temperature.

3. Pressure - Operating and storage: Sea level to 7,000 ft.

I. TECHNICAL REQUIREMENTS (Continued)

4. Sand and Dust: As specified by Procedure I, MIL-E-4970A, except maximum temperature not to exceed +150 deg. F. and except that velocity shall be commensurate with flow rate of 12,000 SCFM through blast valve.
5. Temperature - Shipping and Storage: -65 deg. F. to +150 deg. F.
6. Humidity, Shipping and Storage: 0-95% Releative Humidity at Shipping and Storage Temperatures.
7. Pressure - Altitude, Transportation: Sea Level to 10,000 feet.
8. Fungus: No fungus nutrient materials shall be used in components or finishes.
9. Corrosion Resistance: the blast valves shall withstand the corrosive effects of the exhaust fumes from the diesel engine of the standby generator.

b. Dynamic

In accordance with Paragraphs 15.2 of D2-30028-2

5. Weapons Effects

In accordance with Paragraphs 15.1 of D2-30028-2

6. Monitoring

R 1. Monitoring of the Blast Valve opened and closed positions shall be provided to the Blast Valve Control System (Figure A 1432)

2. A quantitative indication of the Hydraulic and Nitrogen accumulator pressure must be displayed on the hydraulic panel in the LEB.

7. Special Considerations

a. Finish and marking shall conform to the requirements defined in AFBSD Exhibit 62-88.

b. Human Engineering considerations shall conform to the concepts of Section 2.4 of D2-30028-1

c. Electrical Interference considerations shall conform to Paragraphs 3.2.1 thru 3.2.7 and 3.2.9.2 thru 3.2.9.8 of AFBSD Exhibit 62-87

C. Operability and Maintainability

In accordance with D2-30028-1 Section 2.3 the valve shall have a maintenance free life of 3 years with a useful life of 10 years.

D. Reliability

The reliability design objective assigned this system is /cycle and the MCBF is

I. TECHNICAL REQUIREMENTS (Continued)

E. Applicable Documents

D2-30028-1, Operational Ground Equipment Design Discipline Document
D2-30028-2, Structural Design Criteria - Operational Ground Equipment-Minuteman Wing VI, dated 25 March 6[illegible]
AFBSD Exhibit 62-88, Finish Criteria WS-133B Date 11 June 62
AFBSD Exhibit 62-77, Electric Power and Cabling Subsystem Criteria Revision I, 25 October 62
AFBSD Exhibit 62-87, "Electro-~~Interference~~ Control Requirements for Minuteman," dated 6 December 1962

II. RECOMMENDED SOLUTION

It is recommended that the design configuration for the Valve, Blast, 36", Figure A 1428.3, Revision Basic, be used to meet the technical requirements in IA above. This design will be used with changes limited to those required to meet the following Wing VI conditions:

1. Ground Shock (Due to new location, increased shock requirements are imposed)
2. Shock Test (Due to increased structural requirements needed to meet increased Ground Shock)
3. Control (Due to new Diesel Stop and Start sequence)
4. Interface (Due to new location, interface may change slightly)

I. TECHNICAL REQUIREMENTS (Continued)

F. Applicable Documents

D2-30028-1, Operational Ground Equipment Design Discipline Document
D2-30028-2, Structural Design Criteria - Operational Ground Equipment-Minuteman Wing VI, dated 25 March 6
AFBSD Exhibit 62-88, Finish Criteria WS-133B Date 11 June 62
AFBSD Exhibit 62-77, Electric Power and Cabling Subsystem Criteria Revision I, 25 October 62
AFBSD Exhibit 62-87, "Electro-Interference Control Requirements for Minuteman," dated 6 December 1962

II. RECOMMENDED SOLUTION

It is recommended that the design configuration for the Valve, Blast, 36", Figure A 1428.3, Revision Basic, be used to meet the technical requirements in IA above. This design will be used with changes limited to those required to meet the following Wing VI conditions:

1. Ground Shock (Due to new location, increased shock requirements are imposed)
2. Shock Test (Due to increased structural requirements needed to meet increased Ground Shock)
3. Control (Due to new Diesel Stop and Start sequence)
4. Interface (Due to new location, interface may change slightly)

TYPE OF LIST
A [illegible] EQUIPMENT

MODEL DESIGNATION
B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION
C POWER

CONTRACTOR
D [illegible]

FIGURE A NUMBER
E 5002

MILITARY NOMENCLATURE AND FED. MFR'S CODE
F AC-DC CONVERTER, LAUNCHER

COMMON NOMENCLATURE
G

H ORIGINATION DATE 12-62

J AFBSD APP DATE [illegible]

CONTRACT NO.
K [illegible]

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
[illegible]	[illegible]	Initiate PDR	[illegible]																	CP-[illegible]			W-6	2-57-[illegible] 2-57-[illegible]

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

1. A requirement exists to provide a means to convert 120/208 volt, 3 phast, 60 cycle AC primary power to regulated DC power to charge or float charge the emergency power battery supplies and to provide DC power for the following loads:

a. G&C Ground Electronic for Accelerometer Oil Heater (Continuous Load)
b. GES Radio (Intermittant Load)
c. G&C Cooling Controls (Continuous Load)
d. GES Equipment (Continuous Load) -(UTAH, Voice & Data Terminal, -MPCS and Antenna Tuner)
e. G&C Ground Electronics (Continuous Load) - Signal Data Converter Set and G&C Power Conversion Equipment)
f. Ordnance Circuitry (Intermittant Load)
g. Security System (Continuous Load)

2. The converter shall be capable of recharging the batteries from a fully discharged condition, as defined by AFBSD Exhibit 62-77 Paragraph 6.3, within a 96 hour period while supplying DC power to the continuous loads.

R

3. A requirement exists to provide a means to isolate for maintenance purposes and to protect the cables from the effects of short circuit or overload in the following circuits:

a. GES Radio
b. GES Antenna Tuner
c. GES UTAH
d. GES Voice & Data Terminal - MPCS
e. G&C Cooling Equipment DC power
f. Security System

SHEET 1 OF 5 NOMENCLATURE AC-DC CONVERTER, LAUNCHER FIGURE A NUMBER 5002

2-6834-0-5

I. TECHNICAL REQUIREMENTS (Continued)

B. Design Constraints

1. Power

a. The AC-DC Converter, Launcher, shall be designed to receive 120/208 volt, 3 phase, 60 cycle AC primary electrical power having characteristics defined in AFBSD Exhibit 62-77, Paragraph 3.2.1 and convert it to 32 volt DC power having characteristics defined in AFBSD Exhibit 62-77, Paragraphs 3.2.2 and 3.3.1.3.3 for the loads in I.A.1., above. The converter shall meet the ripple requirements of Paragraph 3.3.1.3.3 of AFBSD Exhibit 62-77 for all outputs from zero to the load which will reduce the converter output to 28 volts.

b. The AC-DC Converter, Launcher, shall be designed to distribute the above converted power and/or battery power to the following loads as defined by ICD's

(1) NCU's and TVCU
(2) G&C Ground Electronics for Accelerometer Oil Heater
(3) Emergency Environmental Control
(4) GES Radio
(5) G&C Cooling Controls
(6) Emergency G&C Cooling Equipment
(7) GES Equipment (UTAH Voice & Data Terminal -MPCS and Antenna Tuner
(8) G&C Ground Electronics (Signal Data Converter and G&C Power Conversion Equipment)
(9) Ordnance Circuits
(10) Security System

c. The circuits serving items (1) thru (4), the circuits serving items (5) thru (10) and the primary AC power circuit shall be isolated from each other by at least one megohm prior to external connection.

d. The converter shall be capable of charging completely dead, but operable, batteries without damage to the converter units. Time restrictions do not apply when charging completely dead batteries.

R 2. Physical

The AC-DC Converter, Launcher, shall consist of an assembly designed to be mounted on the Launcher Equipment Room shock isolated floor. Circuit breakers shall be provided only where fault isolation or maintenance requirements of paragraph I.A.3, above, dictate. Proper consideration shall be given to coordination of system protective devices.

I. TECHNICAL REQUIREMENTS (Continued)

3 Interface

R The AC-DC Converter, Launcher, shall interface with Cable Assemblies defined by the Cable Assembly Set, Launcher, Figure A 1248, and the following ICD's:

ICD 25-38225 "Voice, Data and Message Processing Equip. & C163 Converter, Signal Data - Electrical"
ICD 25-38233 "Antenna Tuner Unit - Electrical"
ICD 25-38235 "Radio Set, Command & Status - Electrical"
ICD 25-38229 "C225 Power Converter -Electrical & Cooling"

Additional interface documents will define the following areas.

Security Subsystem
Message Authentication System

R The AC-DC Converter, Launcher, shall interface with RPIE for cooling and installation as defined by applicable FCD's.

4 Environment

The AC-DC Converter, Launcher, shall function in nuclear shock and EMP environments defined by D2-30028-1, Paragraphs 2.1.3.2 and 2.2.4; and an ambient environment defined by D2-30028-1, Paragraph 2.1.2.2A.

5. Weapon Effects

See Paragraph I.B.4, above

6. Monitoring

R A single signal shall be provided to indicate the lack of DC output.

7. Special Considerations

a. Finish and marking shall conform to the requirements of AFBSD Exhibit 62-88

b. The AC-DC Converter, Launcher, shall conform with electrostatic and electromagnetic interference suppression requirements of AFBSD Exhibit 62-75, Section 2.1, and AFBSD Exhibit 62-87, Paragraphs 3.2.1 thru 3.2.7 and 3.2.9.2 thru 3.2.9.4.

I TECHNICAL REQUIREMENTS (Continued)

7. Special Considerations

c. Human Engineering shall be in accordance with D2-30028-1, Section 2.4.

d. Standardization shall conform to AFBSD Exhibit 62-84.

R C. Operability and Maintainability

The AC-DC Converter, Launcher, shall utilize the maintainability, concepts defined in D2-30028-1, Sections 2.3.

D. Reliability

To be determined.

E. Applicable Documents

1. D2-30028-1 "WS-133B Operational Ground Equipment Design Discipline Document Contractual", Revision A, February, 1963.

2. D2-30028-2 "Structual Design Criteria- Operational Ground Equipment, Minuteman Wing VI", February, 1963.

R 3. AFBSD Exhibit 62-77, "Electric Power and Cabling Subsystem Criteria, WS-133B" Revision I. 25 October, 1962

4. AFBSD Exhibit 62-75, "Electrical Grounding Criteria, WS-133B" Revision I, 3 October 1962.

5. AFBSD Exhibit 62-87, "Electro-Interference Control Requirements for Minuteman" 6 December, 1962.

6. AFBSD Exhibit 62-88 "Finish Criteria, WS-133B, " 11 June 1962.

II. RECOMMENDED SOLUTION

It is recommended that the following equipment mounted in a standard Minuteman Electronics Rack be provided to fulfill the technical requirement of Section I, above. Materials and assembly procedures shall conform to the above requirements.

II RECOMMENDED SOLUTION (Continued)

A. Two regulated, constant voltage transformer - rectifier type power supplies to convert Primary AC power to regulated DC power. The power supplies shall have output ratings of 35 amperes and 150 amperes, respectively, at a minimum of 28 volts DC under "Charge" conditions and a maximum of 37.7 volts DC under "Float" conditions. The input requirements of each power supply will be 120 ± 12 volts, 60 cycle, single phase AC power available from a 120/208 volt, 60 cycle, 3 phase AC power supply to the rack. The units shall be forced air cooled

R 1. Detectors will be provided to indicate a lack of proper current in either output. The most probable failures of the monitors will not influence the power supply outputs. The monitor will have continuity for a "normal" condition and an open circuit for an "alarm" condition.

B. A drawer containing six single pole circuit breakers for protection and isolation of the following circuits:

GES Radio
GES antenna Tuner
GES UTAH
GES Voice & Data Terminal - MPCS
G&C Cooling Control and Emergency G&C Cooling
Security Subsystem

C. Multi-pin connectors with crimp-type removable pins, as required.

D. Wire harnesses for internal interconnections, as required

E. Rack ground lug terminal.

A TYPE OF LIST	B MODEL DESIGNATION	C SUB SYSTEM IDENTIFICATION	D CONTRACTOR
OPERATIONAL GROUND EQUIPMENT	SM-80 WEAPON SYSTEM	ENVIRONMENT	THE BOEING COMPANY

E FIGURE A NUMBER	F MILITARY NOMENCLATURE AND FED. MFR'S CODE	G COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	K CONTRACT NO
.006	SHOCK ISOLATORS, LER FLOOR		1-23-3 / 4-9-3	AF 4(6-4)-26

L REVISIONS 1 Date	2 Code	3 Initiated By	4 AFBSD Approval Date	M Functional Class Index	N Stock Number 1 Fed. Supply Class	2 Federal Item ID Number	3 Manufacturer's Part Number	P Basis of Issue and Quota Allocations 1 LP	2 LCP	3 MLCC	4 SMSB	5 SRA	6 MAMS	7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod Lead Time	X End Item Effectivity	Y Remarks
	6A																							
	6A	In-House																						
	6A	PDR	4-9-3																	CFE			W-6	

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to support and protect the following weapon system equipment, located in the launcher equipment room, from seismic and nuclear blast shock effects, per Para. 1B5. The shock attenuation system shall attenuate ground shock inputs to the levels stated in Para. 1b7a and the motion shall be dampened as specified in Para. 1B7a4

Equipment	Units	Shape Factor	Mass C.G.* Location x y z	Estimated Weight	Upper & Lower Bound on Weight w/90% Confidence Level

Remarks:
2.58
2.58.3.15
2.58.3.16
2.58.3.17
2.58.3.18
2.58.3.19

I. TECHNICAL REQUIREMENTS (Continued)

A. Functional Requirements

Equipment	Units	Approx. Shape Factor W x D x H (inches)	Mass. C. G. * Location x y z	Estimated Weight	Upper & Lower Bound on Weight w/90% Confidence Level

*With respect to geometrical center
**170° Floor segement

B. Design Constraints

1. Power

Not applicable

2. Physical

a) The floor configuration is as shown in Figure 8-1 of D2-30081 of first approvided issue.
b) The floor shall be supported vertically by isolators.
c) Constraints shall be put upon the facility contractor to locate the mass C.G. (equipment and floor structural at the geometrical center with acceptable tolerances.

SHEET 2 OF 4 NOMENCLATURE SHOCK ISOLATORS, LER FLOOR FIGURE A NUMBER 5006

2-4834-0-6

I. TECHNICAL REQUIREMENTS (Continued)

3. Interface

The Shock Isolator, LER Floor shall interface with the following RPIE:

a) Launcher Equipment Room Structure
b) Structural Floor Unit (part of Figure A 1330)

4. Environmental

Except as noted herein the design and test requirements pertaining to AGE/OGE in D2-30028-1, Paragraphs 2.1.2.2A and 2.1.2.1 are applicable.

5. Weapons Effects

The paragraphs referenced for the following conditions are found in D2-30028-2.

a) Magnitude and Sequence of attacks - see Paragraph 5.1.1

b) Ground Shock - see Paragraph 5.1.2

6. Monitoring

Not applicable

7. Special Considerations

R

a) The paragraphs referenced for the following conditions are found in D2-30028-2.

1) The shock isolators shall attenuate the ground shock, defined in paragraph IB5 above, to the levels defined in Paragraph 5.4.1.
2) Rattle Space - see Paragraph 5.4.2
3) Permanent Displacement - See Paragraph 5.4.3.

I. TECHNICAL REQUIREMENTS (Continued)

R B. Design Constraints

7. Special Considerations (cont.)

4) Damping time, - see Paragraph 5.4.4
5) For phasing between horizontal and vertical ground shock - see Paragraph 5.2.

b) Structural components shall conform to the requirements of sections 5.5 and 5.6 and section 2.0 except Para. 2.3, 2.4 and 2.5 of D2-30028-2.
c) Finish and Marking shall conform to AFBSD Exhibit 62-88, Dated 11 June 1962.
R d) Human Engineering considerations shall conform to the concepts of Section 2.4 of D2-30028-1.

R C. Operability and Maintainability

The equipment shall be operable in accordance with Paragraph 2.1.2.2A1 of D2-30028-1. The equipment shall be designed for a minimum amount of maintenance in accordance with section 2.3 of D2-30028-1.

D. Reliability

The reliability design objective assigned to this system is cycle and the MCBF is

E. Applicable Documents

1. D2-30028-1, WS-133 Operational Ground Equipment Design Discipline Document, Dated February, 1963.
2. D2-30028-2, Structural Design Criteria - Operational Ground Equipment-Minuteman Wing VI Dated February, 1963.
3. D2-30081, Facility Criteria Document, WS-133B, Launch Facility, Dated.
4. AFBSD Exhibit 62-88, Finish Criteria WS-133B Dated 11 June 1962.

II. R RECOMMENDED SOLUTION

It is recommended that a shock isolation system consisting of eight linear type shock isolators utilizing the design concept of Figure A 1330.3 Revision Basic be provided. The shock isolators will attach to the structural floor at selected locations to suspend the floor in a pendulum fashion from connections embedded in the Launcher Equipment Room structure. The isolators will consist of a double acting coil spring cartridge which will allow attenuation of shock loads. Damping of shock-induced vibrations will be achieved thru the friction inherent in the system.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENTAL	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE / AFBSD APP DATE	CONTRACT NO
E 5007	F SHOCK ISOLATORS, LCEB FLOOR	G	H 1/23/3 ; J 2/8/3	K AF04(694)-26¢

L REVISIONS: Revision Date 1	Code 2	Initiated By 3	AFBSD Approval Date 4	M Functional Class Index	N Stock Number: Fed. Supply Class 1	Federal Item ID Number 2	Manufacturer's Part Number 3	P Basis of Issue and Quota Allocations: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod. Lead Time	X End Item Effectivity	Y Remarks
	6A		2-8-3																					
2-15-3	6A	In-House																		CFE			W-6	
3-4-3	6A	PDR	4-9-3																					

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to support and protect the following weapon system equipn ent, located in the launch control equipment building, from seismic and nuclear blast shock effects, per Para. IB5. The shock attenuation system shall attenuate ground shock inputs to the levels stated in Para. IB7a1 and the motion shall be dampened as specified in Para. IB7a4.

Remarks: 2.53; 2.53.2.16; 2.53.2.17; 2.53.2.18; 2.53.2.19

Equipment	Shape Factor (inches)	Mass C.G.* Location x (feet)	y	z	Estimated Weight lbs.	* Quadrant	Upper & Lower Bound on Weight w/90% Confidence Level
CBR Filter w/Fan	24x24x38	18.00	3.87	1.50	200	1	
Compressed Air Cylinder	9ϕx55	17.04	6.25	2.71	150	1	
Compressed Air Cylinder	9ϕx55	16.21	6.75	2.71	150	1	
Shock Isolation Panel		14.67	7.21	1.75	150	1	
Shock Isolator	20 ϕ	14.92	5.25	3.75		1,2,3,4	
Oil Tank	21 ϕ x54	11.87	6.75	3.75	2000	1	
Day Tank	30 ϕ x54	7.17	6.50	4.25	2000	1	
Air Compressor	42x24x36	11.71	3.50	1.50	500	1	
Steam Separator	16 ϕ x40	6.71	2.50	6.66	400	1	
Oil Filter	12 ϕx48	6.33	4.21	2.00	300	1	

R R

(Continued)

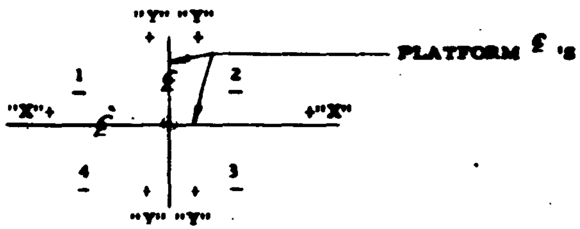
I. TECHNICAL REQUIREMENTS (Continued)

Equipment	Shape Factor inches	Mass C.G.* Location feet x	y	z	Estimated Weight lbs.	* Quadrant	Upper & Lower Bound on Weight w/90% Confidence Level
Diesel Generator	120x42x66	0.62	4.75	3.00	10,000	2	
Batteries (Below Platform)		3.17	1.00	-1.92	250	2	
Sheet Metal Plenum		8.00	5.37	3.00	270	2	
Exhaust Fan	45x42x50	11.00	3.42	2.21	1600	2	
Shock Isolation Panel		14.67	7.21	1.75	150	2	
Compressed Air Cylinder	90x55	16.21	6.75	2.71	150	2	
Compressed Air Cylinder	90x55	17.04	6.25	2.71	150	2	
Electrical Panels		17.58	0.00	3.75	4500	2, 3	
Shock Isolation Panel		18.17	5.25	1.75	150	3	
Compressed Air Cylinder	90x55	17.17	6.25	2.71	150	3	
Compressed Air Cylinder	90x55	16.46	6.66	2.71	150	3	
Hydraulic Unit	52x40x48	11.42	5.83	2.00	1500	3	
Supply Fan	45x42x50	6.25	5.25	2.16	1600	3	
Sheet Metal Duct		5.67	5.25	7.50	400	3	
Sheet Metal Plenum		1.29	5.25	5.21	400	3	
Sheet Metal Duct (Below Platform)		0.39	0.50	-1.75	1100	4	
Package Chiller	108x56x90	5.02	5.25	5.21	8000	4	
Sheet Metal Plenum		11.25	5.25	5.21	330	4	
Shock Isolation Panel		14.67	7.21	1.75	150	4	
Compressed Air Cylinder	90x55	16.21	6.75	2.71	150	4	
Compressed Air Cylinder	90x55	17.04	6.25	2.71	150	4	
Compressed Air Cylinder	120x60	18.67	4.63	2.50	300	4	
Compressed Air Cylinder	120x60	19.29	3.66	2.50	300	4	
Air Compressor Dryer Unit	19x12x43	18.00	3.58	1.87	175	4	
Conduits and Cables					1000		
Brine Piping					1000		
Platform					25,000		
Composit Total Wt.					64,925		

R

I. **TECHNICAL REQUIREMENTS** (Continued)

e



B. Design Constraints

1. Power

Not Applicable

R 2. Physical

a) The floor configuration is as shown in Figure 8-1 of D2-30082 first approved issue.
b) The floor shall be supported vertically by isolators.
c) Constraints shall be put upon the facility contractor to locate the max. C.G. (Equipment and floor structure) at the geometrical center with acceptable tolerances.

3. Interface

The Shock Attenuation System, LCEB shall interface with the following RPIE:

a) Launch Control Equipment Building Structure
b) Structural Floor Unit (Part of Figure A 1439)

R 4. Environmental

Except as noted herein, the design and test requirements pertaining to AGE/OGE in D2-30028-1 Paragraphs 2.1.2.2c and 2.1.2.1 are applicable.

I TECHNICAL REQUIREMENTS (Continued)

R 5. Weapons Effects

The paragraphs referenced for the following conditions are found in D2-30028-2.

R a) Magnitude and Sequence of Attacks - see paragraph 10.1.1

b) Ground Shock - see paragraph 10.1.2

6. Monitoring

Not Applicable

7. Special Considerations

a) The paragraphs referenced for the following conditions are found in D2-30028-2

1) The shock isolators shall attenuate the ground shock defined in Paragraph IB5 above to the levels defined in Paragraph 10.4.1
2) Rattle Space - See Paragraph 10.4.2
3) Permanent Displacement - see Paragraph 10.4.3
4) Damping time - see Paragraph 10.4.4
R 5) For phasing between horizontal and verticle ~~ground shock~~, see Paragraph 10.2.

R b) Structural Components shall conform to the requirements in D2-30028-2, Section 10.6 and Section 2.0 except 2.3, 2.4, & 2.5

c) Finish and Marking shall conform to AFBSD Exhibit 62-88

d) Human Engineering considerations shall conform to the concepts of section 2.4 of D2-30028-1

R C. Operability and Maintainability

The equipment shall be operable in accordance with Paragraph 2.1.2. C.6 of D2-30028-1
The equipment shall be designed for a minimum amount of maintenance in accordance with Section 2.3 of D2-30028-1. The equipment shall have a useful life of 10 years.

D. Reliability

The reliability design objective assigned to this system is cycle and the MCBF is

I. TECHNICAL REQUIREMENTS (Continued)

E. Applicable Documents

1. D2-30028-1,"WS-133B Operational Ground Equipment Design Discipline Document Dated February, 1963.

2. D2-30028-2,"Structural Design Criteria- Operational Ground Equipment-Minuteman Wing VI. Dated February, 1963

R 3. D2-30082,"Facility Criteria Document, Launch Control Facility, Dated

4. AFBSD Exhibit 62-88,"Finish Criteria WS-133B, Dated 11 June 62.

R II. RECOMMENDED SOLUTION

It is recommended that a shock attenuation system consisting of four pneumatic shock isolator units identical to Figure A 1421.2 Revision A be provided. The isolators will attach to the structural floor unit near the corners to suspend the floor in pendulum fashion from connections embedded in the Launch Control Equipment Building structure. Each shock isolator is comprised of a pneumatic cylinder and piston, a spring to provide a balancing force required to achieve equilibrium in the system in the normal (neutral) position, and air pressure tank built around the cylinder, a compressed air supply, valves, control system and accessory equipment.

TYPE OF LIST: A OPERATIONAL GROUND EQUIPMENT

MODEL DESIGNATION: B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION: C ENVIRONMENT

CONTRACTOR: D THE BOEING COMPANY

FIGURE A NUMBER: E 5008

MILITARY NOMENCLATURE AND FED. MFR'S CODE: F SHOCK ISOLATORS, LEB FLOOR

COMMON NOMENCLATURE: G

H ORIGINATION DATE: 1/23/3

J AFBSD APP DATE: 2/8/3

CONTRACT NO: K AF04(694)-2..

Revision Date	Code	Initiated By	AFBSD Approval Date
	6A		2-8-3
2/15/3	6A	In-House	
3/4/3	6A	PDR	4-9-3

M Functional Class Index	N Fed. Supply Class	Federal Item ID Number	Manufacturer's Part Number	P Basis of Issue and Quota Allocations (LP, LCP, MLCC, SMSB, SRA, MAMS, 7, 8)	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod. Lead Time	X End Item Effectivity	Y Remarks
									CFE			W-6	2.58 2.58.3.5 2.58.3.6 2.58.3.7 2.58.3.8

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to support and protect the following weapon system equipment located in the Launcher Equipment Building, from seismic and nuclear blast shock effects, per Paragraph IB5. The shock attenuation shall attenuate ground shock inputs to the levels stated in Paragraph IB7a and the motion shall be dampened as specified in Paragraph IB7a4.

Equipment	Shape Factor inches	Mass C.G. *Location x (feet)	y	z	Estimated Weight lbs.	* Quadrant	Upper and lower Band or Weight w/90% Confidence Level
Air Compressor	42x24x48	16.66	3.58	1.00	500	1	
Shock Isolator	140x120	13.50	5.25	5.41		1,2,3,4	
Absolute Filter	24x24x24	11.75	7.62	2.00	100	1	
Absolute Filter Fan	24x24x24	9.75	7.62	0.75	100	1	
Hydraulic Unit	52x40x48	9.92	3.92	2.00	1500	1	
Supply Fan	59x56x74	5.06	4.41	3.62	2000	1	
Package Chiller	90x50x90	2.83	5.21	3.33	5000	2	
Sheet Metal Plenum	72x39x90	6.63	5.25	3.33	550	2	
Air Compressor Dryer Unit	19x12x43	10.92	8.16	1.87	175	2	
Compressed Air Cylinder	12Ø 60	9.50	8.16	2.50	300	2	
H & V Panel	30x14x90	12.37	1.58	3.75	500	2	
Interface Panel	30x14x90	14.96	1.58	3.75	400	2	
Power & Grounding Transformers	28x28x90	17.33	0.97	2.50	1600	2	

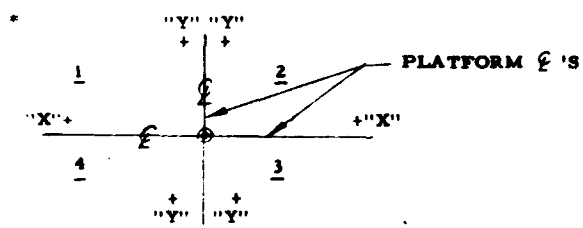
(Continued)

I. **TECHNICAL REQUIREMENTS**

A. Functional Requirements (Continued)

Equipment	Shape Factor inches	Mass C.G. *Location x (feet)	y (feet)	z (feet)	Estimated Weight lbs.	* Quadrant	Upper and lower Band on Weight w/90% Confidence Level
Main Brakers	24x28x90	17.33	1.16	3.75	1400	3	
Engine Cranking & Generator Control	24x28x90	17.33	3.12	3.75	600	3	
Power Panels	30x14x90	14.96	0.41	3.75	500	1	
Alarm Panel	30x14x90	12.37	0.41	3.75	500	1	
Sheet Metal Duct (Below Platform)		4.46	0.46	-2.00	500	2	
Exhaust Fan	74x56x64	10.08	5.41	3.37	2000	3	
Sheet Metal Plenum	63x63x67	5.08	5.50	2.79	260	3	
Batteries (Below Platform)	96x15x18	2.25	3.87	-2.00	300	4	
Diesel Generator	120x42x60	2.71	6.37	2.00	6500	4	
Day Tank	30 ϕx54	11.16	7.29	4.25	2000	4	
Oil Filter	12 ϕx48	12.29	3.58	2.00	200	4	
Lube Oil Tank	21 ϕx54	15.50	3.58	3.75	1000	4	
Sheet Metal		0.25	5.23	5.00	400	1	
Compressed Air Cylinder	12 ϕx60	12.37	8.16	2.50	300	2	
Conduits and Cables					1000		
Piping					1000		
Platform					26,000		
Composit Total Weight					57,185		

*



R

(Continued)

I. TECHNICAL REQUIREMENTS (Continued)

B. Design Constraints

1. Power

Not Applicable

2. Physical

R
a) The floor configuration is as shown in Figure 6-1 of D2-30081 first approved issue.
b) The floor shall be supported vertically by linear isolators
c) Constraints shall be put upon the facility contractor to locate the mass C.G. (equipment and floor structure) at the geometrical center with acceptable tolerances.

3. Interface

The Shock Isolators, LEB Floor shall interface with the following RPIE:
a) Launcher Equipment Building Structure
b) Structural Floor Unit (Part of Figure A 1441)

R
4. Environmental

Except as noted herein, the design and test requirements pertaining to AGE/OGE in D2-30028-1, Paragraphs 2.1.2.2B and 2.1.2.1 are applicable.

5. Weapons Effects

The Paragraphs referenced for the following conditions are found in D2-30028-2
a) Magnitude and Sequence of attacks - See Paragraph 11.1.1
b) Ground shock - see 11.1.2

6. Monitoring

Not Applicable

(Continued)

I. TECHNICAL REQUIREMENTS (Continued)

B. Design Constraints (Cont'd.)

7. Special Considerations

a) The paragraphs referenced for the following conditions are found in D2-30028-2
   1) The shock isolators shall attenuate the ground shock as defined in Paragraph IB5 above to the levels defined in Paragraph 11.4.2
   2) Rattle Space - See Paragraph 11.4.3
   3) Permanent Displacement - See Paragraph 11.4.4
   4) Damping Time - See Paragraph 11.4.5
   R 5) For phasing between horizontal and vertical ground shock see Paragraph 11.2

R b) Structural components shall conform to the requirements of D2-30028-2, Sections 5.5 and 5.6 and 2.0 except Paragraphs 2.3, 2.4. & 2.5.

c) Finish and Marking shall conform to AFBSD Exhibit 62-88.

d) Human Engineering considerations shall conform to the concepts of Section 2 4 of D2-30028-1

C. Operability and Maintainability

The equipment shall be designed for a minimum amount of maintenance in accordance with section 2.3 of D2-30028-1. The equipment shall have a useful life of 10 years.

D. Reliability

The reliability design objective assigned to this system is cycle and the MCBF is

(Continued)

I. TECHNICAL REQUIREMENTS (Continued)

E. Applicable Documents

1. D2-30028-1, WS-133 Operational Ground Equipment Design Discipline Document dated February, 1963
2. D2-30028-2, Structural Design Criteria-Operational Ground Equipment - Minuteman Wing VI dated February, 1963
3. AFBSD Exhibit 62-88, Finish Criteria WS-133B dated 11 June 62
4. D2-30081, Facility Criteria Document, WS-133B Launch Facility, dated

R

II. RECOMMENDED SOLUTION

It is recommended that a shock isolation system consisting of four linear type shock isolators utilizing the design concept of Figure A 1441.3 Revision Basic be provided. The shock isolators will attach to the structural floor near the corners to suspend the floor in a pendulum fashion from connections embedded in the Launcher Equipment Building structure. The isolators will consist of a double acting coil spring cartridge which will allow attenuation of shock loads. Damping of shock-induced vibrations will be achieved thru the friction inherent in the system.

SHEET 5 OF 5 NOMENCLATURE SHOCK ISOLATORS, LEB FLOOR FIGURE A NUMBER 5006

2-68340-6

TYPE OF LIST: OPERATIONAL GROUND EQUIPMENT	MODEL DESIGNATION: SM-80 WEAPON SYSTEM	SUB SYSTEM IDENTIFICATION: 85196-306	CONTRACTOR: AUTONETICS A Division of North American Aviation, Inc.
FIGURE A NUMBER: 13000	MILITARY NOMENCLATURE AND FED MFR'S CODE (94756)	COMMON NOMENCLATURE: CONVERTER SET, SIGNAL DATA (C163A)	ORIGINATION DATE: 9-29-62; AFBSD APP DATE: 3-11-63; CONTRACT NO. AF04(694)-247

REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	LF	LCF	MLCC	SMSB	SBA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
9/29/62	6A	CDS		BB-2.3	MBAH 4935			1									*** $23,000			CFE		55 wks.	W-6	Unclassified

I. TECHNICAL REQUIREMENTS

A requirement exists for a means, at the Launch Facility (LF), to receive all ground status inputs and make this information available to the Airborne Computer upon interrogation, and also to receive commands from the D37B Digital Computer Unit (DCU) Figure A, Item 6275, and cause these commands to be converted into the appropriate actions. A requirement also exists to provide the necessary input and output circuits to enable programming of the DCU, and provide a means for system activation.

WS-133B Form B Reference

A. FUNCTIONAL REQUIREMENTS

A requirement exists for a means of performing the following functions to satisfy the above Technical Requirement:

1. Control the activation and de-activation of the following elements of G & C ground power:

Block # 3.15.2, 3.44, 3.46.

   a. DCU power
   b. Gyro Start power
   c. Hydraulic power (all stages)
   d. Flight Control Electronics power (all stages)
   e. Internal power necessary to fulfill the requirements of this Figure A.

***The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE CONVERTER SET, SIGNAL DATA (C163A)

FIG A NUMBER 13000

SHEET 1 OF 8

PRELIMINARY DATA. NOT TO BE USED FOR PROCUREMENT.

1. TECHNICAL REQUIREMENTS (Cont'd)

A. FUNCTIONAL REQUIREMENTS (Cont'd)

2. Provide continuous monitoring of certain critical and/or safety items in the launch facility and missile, and provide for automatic shutdown of G&C ground power under unsafe conditions. These critical and/or safety items are:	Block # 2, 28, 3
a. Interruption of Re-entry Vehicle (R/V) warhead monitoring loop. (except during launch countdown sequence) Monitor current shall not exceed 100 ma. even in case of single component failures.	
b. Interruption of R/V Arming & Fusing System (AFS) monitoring loop. (except during launch countdown sequence) Monitor current shall not exceed 100 ma. even in case of single component failures.	
c. Missile Safe & Arm devices (S&A) not safed except when commanded to arm during launch countdown sequence.	
d. While in remote operation shutdown will occur upon the second loss of the keep alive code after once attaining Strategic Alert provided that Strategic Alert was not reached before the second loss. (except during launch countdown sequence).	
e. Malfunction of circuits used to monitor critical and/or safety items listed above. (except during launch countdown sequence).	
3. Condition digital input and output signals to provide compatibility with standard logic interface levels.	
4. Monitor and provide to the DCU all appropriate elements of LF status and OGE control signals.	Block # 2, 27, 2, 3
5. Control, under DCU command, and monitor re-entry vehicle (R/V) fuze settings. Control and monitor currents shall not exceed 100 ma. including transients and single component failures.	Block # 2, 27, 2
6. Control (under command of the DCU) and monitor the missile Safe and Arm devices (S&A's). Monitor currents shall not exceed 100 ma, including transients. Provide a Safe and Arm devices safing signal in event of a G&C Power Shutdown.	Block # 2, 27, 1
7. a) Control the LF Safety Control Switch (SCS) under command of the DCU in accordance with commands received by the DCU from Launch Enable System (LES).	Block # 2, 28, 4, 3
b) Monitor the SCS.	
8. Activate, under control of the DCU, the missile secondary ordnance, LF ordnance and Stage I Ignition ordnance, and monitor these functions.	Block # 2, 28, 3
9. Provide enabling control and appropriate status information to the Auxiliary Status Generator (ASG), which is an element of the ground electronics system (GES).	
10. Provide control functions for loading (filling and verifying) the DCU.	Block # 2, 8
11. Perform self test and ground system tests under command of the DCU.	
12. Perform, under DCU command, the functions necessary for execution of the launch sequence.	
13. Initiate power shutdown sequence ____ ± ____ seconds after receipt of "Start Shutdown Timer" character output code issued by the DCU as part of the launch sequence.	

I. TECHNICAL REQUIREMENTS (Cont'd)

B. DESIGN CONSTRAINTS

The exceptions and/or deviations which are taken to applicable design constraints are listed and explained in the supplement to this Figure A.

1. Power: The equipment shall be capable of operating from the DC emergency power source as specified in AFBSD Exhibit 62-77.

2. Physical: The equipment shall be housed in a Government Furnished Equipment (GFE) cabinet, Boeing Part No., BAC C60B05H2D02 and shall contain provisions for lifting by a suitable sling.

3. Interface: The end item shall electrically interface through a junction box with the following:

a. G&C Umbilical. (AID 10008-III)
b. Shirt Umbilical. (AID 10008-III)
c. Message Processing and Control System equipment (GES). (ICD 25-38225)
d. Auxiliary Status Generator (GES). (ICD 25-38225)
e. Collimator Set AN/GJQ22 (C21Q), Figure A, Item 602.3. (AID 10016-III).
f. G&C Power Conversion Equipment (C225A), Figure A, Item 13002. (AID 10016-III)
g. LF Safety Control Switch. (ICD 25-38225)
h. LF Environmental Control Subsystem. (ICD 25-38225)
i. LF Security Subsystem (ICD 25-38225)
j. LF Power Subsystem. (ICD 25-38225)
k. G&C Ground Cooling Subsystem. (ICD 25-38225)

This equipment shall also electrically (AID #10010-III) and mechanically (AID #10013-III) interface with the Signal Data Converter (C164A), Figure A, Item 13200 and Control Monitor (C166A), Figure A, Item 13200.

4. Environmental: The equipment shall conform to applicable environmental requirements as defined in AFBSD Exhibit 62-51. The equipment shall also conform to the electro-interference requirements of AFBSD Exhibit 62-87.

5. Weapons Effect: The equipment shall conform to the requirements of AFBSD Exhibit 62-83 as a design objective.

6. Monitoring: The equipment shall be capable of monitoring functions which are critical to completion of the launch sequence, (LF ordnance discrete switches) or which are required to be carried out following a DCU system shutdown.

7. Operating Life: The equipment shall be designed to provide capability of 3 year operation in the Strategic Alert Condition.

8. Safety Considerations: Provisions shall be made in the equipment to shutdown both missile and/or ground power and safe all missile ordnance devices in the event a critical malfunction occurs within the equipment.

9. Special Considerations: The equipment shall conform to the electrical grounding requirements of AFBSD Exhibit 62-75.

C. OPERABILITY AND MAINTAINABILITY

The equipment shall be compatible with the requirements imposed by the Weapon System Design Criteria and Human Engineering requirements for operability and maintainability with the applicable portions of AFBSD Exhibits 62-53 and 61-99.

I. TECHNICAL REQUIREMENTS (Cont'd)

D. RELIABILITY

The equipment shall conform to the requirement for standardization of parts as established by Autonetics Minuteman standard parts and as defined in the weapon system design criteria. (AFBSD Exhibit 62-50, and Exhibit "R" of Letter Contract AF04(694)-247).

E. APPLICABLE DOCUMENTS

Deviations have been taken to those applicable paragraphs as noted. The deviations and the reasons for these deviations will constitute a supplement to this Figure A. The approved deviations are to be incorporated by official addendum to the BSD Design Criteria Documents.

1. AFBSD Exhibit 62-50, dated 12 June 1962, titled Reliability Design Criteria. Paragraph 4.4
2. AFBSD Exhibit 62-51, dated 12 June 1962, titled WS-133B Environmental Design Criteria Minuteman. Paragraph 3.3.2.h(8) and 3.3.3.6 (8).
3. AFBSD Exhibit 62-53, dated 20 June 1962, titled WS-133B Maintainability Design Criteria. Paragraph 7a and 3e.
4. AFBSD Exhibit 62-58, dated 1 February 1963, titled Design Criteria for WS-133B Guidance and Control Subsystem (Airborne and Ground). Paragraph 4.1.6, 4.3.2.1.2, 4.3.2.1.6, 4.3.2.2.1.1.4, 4.3.2.2.2.5, 4.3.3.1.
5. AFBSD Exhibit 62-75, dated 7 June 1962, titled Electrical Grounding Criteria for WS-133B Minuteman Weapon System. Paragraphs 2.1.2, 2.1.3, 2.1.4, 2.1.6, 2.3.2.2, and 2.4.4.
6. AFBSD Exhibit 62-77, revised 25 October 1962, titled Power and Cabling Subsystem Design Criteria (Minuteman) Paragraphs 3.3.1.3.2.
7. AFBSD Exhibit 62-82, dated 15 May 1962, titled WS-133B Weapon System Safety Criteria.
8. AFBSD Exhibit 62-83, dated 20 June 1962, titled WS-133B Weapons Effect Criteria.
9. AFBSD Exhibit 62-84, not dated, titled Standardization Exhibit (Entirety).
10. AFBSD Exhibit 62-87, dated 15 June 1962, titled Electro-Interference Control Requirements for Minuteman (WS-133B). Paragraph 1.1, 3.1.1.
11. AFBSD Exhibit "R" to Letter Contract AF04(694)-247.
12. AFBSD Exhibit 61-99, dated 1 February 1962, titled Human Engineering Design Criteria.

II. RECOMMENDED SOLUTION

It is recommended that Autonetics design and fabricate an equipment designated as the Converter Set, Signal Data (C163A), to fulfill the above technical requirements. The Signal Data Converter Set will perform the functions listed below.

A. FUNCTIONAL DESCRIPTION

General - The C163A Converter Set, Signal Data, operating in conjunction with the DCU will establish the basic mode of operation within the Launch Facility (LF) and will provide monitoring and control of functions both in the missile and in the LF ground equipment. In conjunction with the C164A Signal Data Converter (Figure A, Item 13200) and C166A Control Monitor (Figure A, Item 13201) portable MGE which will provide various controls and indicators, the C163A Converter Set will be capable of carrying out maintenance and test operations at the LF. The C163A Converter Set will provide for both LOCAL and REMOTE modes of operation and perform the following basic functions. Block F3.15.2

1. The C163A Converter Set will control the activation and de-activation of G&C ground power. Upon receipt of a command from the C166A Control Monitor (Figure A, Item 13201) the C163A Converter Set will command the C225A G&C Power Conversion equipment (Figure A, Item 13002) to either provide or remove power to the G&C subsystem (as specified in section I-A1). Automatic power de-activation will also be accomplished by command from the DCU or from monitoring circuits within the C163A Converter Set. Block F3.15.2

FIGURE A NUMBER 13000
SHEET 4 OF 8

REV SYM B

II. RECOMMENDED SOLUTION (Cont'd)

A. FUNCTIONAL DESCRIPTION (Cont'd)

Block # 2.28.5

2. The C163A Converter Set will provide continuous monitoring of certain critical and/or safety status within the LF (as specified in section I-A2), and provide for automatic shutdown of G&C ground power under unsafe conditions.

3. The C163A Converter Set will condition input and output signals to provide compatibility with standard logic interface levels.

4. The C163A Converter Set will monitor all appropriate elements of LF status and provide this status information to the DCU upon command from the computer. This status information will also be available to the C166A Control Monitor (Figure A, Item 13201).

5. The C163A Converter Set will supply, under DCU command, fuse setting signals to the R/V and will monitor this fuse setting. The C163A will also monitor the R/V warhead and AFS, for an unsafe condition. The monitor currents shall not exceed 100 ma, even in case of single component failures.

6. The C163A Converter Set will control, under DCU command, the safing and arming of the A/B safe and arm (S&A) devices and will continuously monitor these devices for any unsafe condition (except when commanded to arm during the launch countdown sequence). Safing shall also occur during site shutdown due to a malfunction or unsafe condition. The monitoring current shall not exceed 100 ma.

7. The C163A Converter Set will control, under DCU command, the safing and arming of the Safety Control Switch (SCS), and will continuously monitor the SCS.

8. The C163A Converter Set will provide and monitor ordnance discrete power switches used to activate launch facility ordnance devices upon both enabling and command from the DCU. The nature of the pulse which must be delivered to the electrical initiators by the power switches shall be as follows:

amplitude: 4.5 to 9.0 amperes/bridgewire
rise time: 10% to 90% of full amplitude to be less than 1.0 milliseconds.
duration: 20.0 ± 0.1 milliseconds minimum.

9. The C163A Converter Set will enable the Auxiliary Status Generator (ASG) and provide it with appropriate status information during LOCAL operation or following a G&C Shutdown.

10. The C163A Converter will control, via the C166A Control Monitor (Figure A, Item 13201) and the C164A Signal Data Converter (Figure A, Item 13200), loading (fill and verify) of the DCU memory.

11. The C163A Converter Set will control filling of maintenance tapes into the DCU for purposes of DCU self-test and to aid fault isolation of LF equipment.

12. The C163A Converter Set will perform, under DCU command, the functions necessary for the execution of the launch sequence.

13. Initiate power shutdown sequence * seconds after receipt of "Start Shutdown Timer" character output code issued by the DCU as part of the launch sequence.

B. DESIGN DESCRIPTION

The C163A Converter Set, Signal Data will be designed to satisfy the following features and requirements:

1. Power: +37.7 VDC maximum, measured at the C163A input terminals (under emergency conditions the C163A Converter Set will continue to operate even though the voltage may decay to +27.5 VDC, at the C163A input terminals, over a six hour period.) Normal power consumption measured at the input to the C163A Converter Set, will be approximately 200 watts.

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

2. Physical:

a. Cabinet, Electrical Equipment (GFP), Boeing Part No. BAC C60B05H2D02.

Length: 69 5/8 inches
Width: 24 inches
Depth: 26 inches

b. Removable Cable Assemblies (2)

(1) Power cable assembly
(2) Signal cable assembly

c. Signal Data Converter drawer (C163A)

Autonetics will mount drawer slides, removable cable assemblies and necessary cabinet enclosure panels to the cabinet (GFP). The cabinet will also contain provisions for lifting by a suitable sling. The Signal Converter drawer will be mounted on quick disconnect slides.

The cabinet will contain an area to house the suitcase type C164A Signal Data Converter (Figure A, Item 13200) and the C166A Control Monitor (Figure A, Item 13201) when in use. These equipments will be located in accordance with Human Factors documents AFBSD 61-99. The two cable assemblies will be designed to interconnect the drawer and suitcase connectors and external connectors. It will be mounted so that removal of any unit can be accomplished from the front of the console.

3. Interface: The Signal Data Converter Set will interface through a junction box, electrically, with the following:

a. G&C Umbilical (AID 10008-111)
b. Skirt Umbilical (AID 10008-111)
c. Message Processing & Control System Equipment (GES) (ICD 25-38225)
d. Auxiliary Status Generator (GES) (ICD 25-38225)
e. C21Q Collimator Set (AID #10015-111) (Figure A, Item 602.3)
f. C225A G&C Power Conversion equipment (AID #10016-111) (Figure A, Item 13002)
g. LF Safety Control Switch (ICD 25-38225)
h. LF Environmental Control Subsystem (ICD 25-38225)
i. LF Security Subsystem (ICD 25-38225)
j. LF Power Subsystem (ICD 25-38225)
k. G&C Ground Cooling Subsystem (ICD 25-38225)

The Signal Data Converter Set (C163A) will also interface electrically (AID #10010-111) and mechanically (AID #10013-111) with the C164A Signal Data Converter and the C166A Control Monitor.

4. Environmental: The equipment will be designed to meet the following natural and induced environmental conditions which it must withstand during transportation, handling, storage, and use.

a. Air Conditioning - The equipment will be designed to operate when connected to an external source of cooling air having the following characteristics:

(1) Inlet temperature of +53°F to +57°F.

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

4. a. (2) Humidity, H = 105-3T/4, where H = relative humidity in percent and T = temperature (Fahrenheit). The outlet temperature will be + 67° F. maximum when the equipment is operating and supplied with the above cooling air.

b. Temperature Conditions -

(1)	Transportation and handling non-operating	-65°F. to + 150°F. for periods up to 15 days
(2)	Storage - non-operating	-40°F. to +115°F. for indefinite periods
(3)	Operational area-operating	+60°F. to +80°F.
(4)	Emergency temperature conditions	The equipment shall be capable of operating for a period of 6 hours while subjected to inlet cooling air temperature rising linearly from +70°F. to +90°F. during this period.

c. Altitude

(1)	Non-operating	Sea level to 50,000 ft.
(2)	Operating	Sea level to 7,000 ft.

d. Humidity

(1)	Non-operating	0 to 95 percent relative humidity
(2)	Operating	0 to 60 percent relative humidity

e. Vibration

(1)	Non-operating	3.5 g rms, 5 to 50 cps (limited to 0.5 in. double amplitude) 1.5 g rms, 50 to 300 cps.
(2)	Operating	5 g rms, 2 to 12 cps (limited to 6 in. double aplitude) 2 g rms, 12 to 2000 cps.

f. Shock

(1)	Non-operating	Shocks which may result in acceleration peaks of the order of 100 g.
(2)	Operating	Not applicable.

g. Fungus

The equipment will be designed to withstand fungus growth occurring on nutrient organic materials, including contamination from grease, oils, dust, etc., for all conditions exceeding 60 percent relative humidity and 60°F. Growth is minimal below these limits.

h. Sand and Dust

The equipment will be designed to withstand sand and dust particles as encountered in desert areas under low velocity wind conditions.

i. Electro-Interference: The C163A Signal Data Converter Set will be capable of operating when subjected to the electro-interference requirements as defined in AFBSD Exhibit 62-87.

5. Weapons Effects: The C163A Signal Data Converter Set will be designed to meet the mechanical and electrical environments as defined in the following paragraphs of AFBSD Exhibit 62-83, as a design objective.

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

5. a. Pressure - 4.A.1.b
   b. Shock - 4.A.2.a
   c. Nuclear Radiation - 4.A.3.a
   d. Temperature - 4.A.4.a
   e. Electro-Magnetic - 4.A.5
   f. Detection - 4.A.6
   g. Acoustic - 4.A.8

6. Monitoring: The C163A Signal Data Converter Set will be capable of monitoring functions which are critical to launch safety or which are required to be carried out following a G&C System shutdown.

7. Operating Life: The C163A Signal Data Converter Set will be designed to provide the capability of 3 year operation in the Strategic Alert Condition.

8. Safety Considerations: In the event an anticipated malfunction occurs in the "monitoring unit" of the C163A Signal Data Converter Set, all missile power and/or ground power in the LF will be de-activated. In addition to this consideration, the C163A Signal Data Converter Set will also be designed to fulfill the applicable portions of AFBSD Exhibit 62-82. The C163A will also issue control signals to safe all missile ordnance devices that are not already safed, in the event a critical malfunction occurs within the equipment.

9. Special Considerations - None

C. OPERABILITY AND MAINTAINABILITY

The C163A Signal Data Converter Set will be designed to meet the requirements set forth by the design criteria in regard to human engineering requirements and packaging requirements. The C163A will be operated either remotely from the LCF via commands from the DCU, or locally by commands from the C166A Control Monitor (Figure A, Item 13201). There are no controls or indicators on the C163A drawer or cabinet excluding possible power supply fuse indicators. The C163A drawer, because of its design and construction will be sent to the SMSB for repair.

D. RELIABILITY

The C163A Signal Data Converter Set will conform to the requirement for standardization of parts as established by Minuteman Standard parts and defined in the weapons system design criteria.

E. REFERENCE DOCUMENTS

Contractors applicable documents to be included at a later date.

TYPE OF LIST: OPERATIONAL GROUND EQUIPMENT

MODEL DESIGNATION: SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION: 85199-306

CONTRACTOR: Autonetics, A Division of North American Aviation, Inc.

FIGURE A NUMBER: 13002

MILITARY NOMENCLATURE AND FED MFR'S CODE (94756)

COMMON NOMENCLATURE: G. & C. POWER CONVERSION EQUIPMENT (C225A)

ORIGINATION DATE: 9-28-62

AFBSD APP DATE: 3-11-63

CONTRACT NO.: AF04(694)-247

REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	FUNCTIONAL CLASS INDEX	FED SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	LF	LCF	MLCC	SMSB	SRA	MAMS			TOTAL ON ORDER	ESTIMATED UNIT PRICE	ESTIMATED TOTAL PRICE	COGN LAB CTR & SERVICE	PROPOSED SOURCE OF SUPPLY	SOURCE CODE	EST PROD LEAD TIME	END ITEM EFFECTIVELY	REMARKS
1				2	3			4								5	6	7	8	9	10	11	12	13
9/28/62	6A	CDS		BB-2.1				1												CFE		53 WKS	W-6	Unclassified

I. TECHNICAL REQUIREMENTS

A requirement exists for a means at the Launch Facility to provide ground power to the following Airborne Guidance and Control Subsystems.

WS-133B Form B Reference 2.57 3.44.1

1. NS17 Guidance Set (Figure A, Item 6275) — 2 57 71

   a. Digital Computer Unit (DCU) D37B

   b. Inertial Measurement Unit (IMU)

   c. Control and Discrete Unit (CDU) P92

2. Stage I — 2 57. 72

   Stage I Flight Control Electronics

3. Stage II — 2. 57. 72

   a. Angular Accelerometer Unit (AAU) Heaters

   b. AAU Electronics

   c. Stage II Flight Control Electronics

***The estimates set forth herein are submitted for budgetary and planning purposes only and do not constitute a firm commitment on the part of North American Aviation, Inc.

NOMENCLATURE G&C POWER CONVERSION EQUIPMENT (C225A)

FIG A NUMBER 13002

PRELIMINARY DATA NOT TO BE USED FOR PROCUREMENT

SHEET 1 OF 12

6 9-1-62

I. <u>TECHNICAL REQUIREMENTS</u> (Cont'd)

4. Stage III — 2.57.74

Stage III Flight Control Electronics

A requirement exists to provide power to the Collimator Set, C2IQ, (Figure A, Item 602.2) an item of Operational Ground Equipment. — 2.57.76

A requirement exists to provide power for the turn on of Flight Control Hydraulics Power. — 2.57.72

A. <u>FUNCTIONAL REQUIREMENTS</u> — 2.57.73, 2.57.74

The following functional requirements are imposed upon the proposed and item equipment in order to fulfill the preceding technical requirements.

1. NS17 Guidance Set (Figure A, Item 6275)

a. DCU and IMU

(1) +28 ± 1 volt dc at the sense point within the missile, for current loads of 5 to 31 amperes.

(2) Ripple shall not exceed 300 millivolts rms or 1.0 volt peak-to-peak, as measured into a resistive load at the missile sense point.

(3) Overvoltage and undervoltage monitoring shall be provided:

An alarm condition signal shall exist for voltages less than +26.0 volts dc ±3.0% or greater than +30.0 volts dc ±3.0% as measured at the missile sense point.

b. IMU Gyros and Fan Motor Starting Power.

(1) +39.5 to +45.0 volts dc at the G&C umbilical connector at 6.5 amperes average superimposed with a 2 amperes peak-to-peak 2.4 kilocycle sawtooth variation.

(2) Overvoltage and undervoltage monitoring shall be provided:

a no-go condition signal shall exist for voltages less than +38.5 volts dc ± 3.0% or greater than +46.0 volts dc ±3.0%.

c. CDU

(1) + 28 ±2 volts dc at the G&C umbilical connector at 0.5 to 1.5 amperes normal load.

(2) Ripple shall not exceed 200 millivolts rms or 500 millivolts peak-to-peak as measured into a resistive load at the G&C umbilical connector.

I. TECHNICAL REQUIREMENTS (cont'd)

A. FUNCTIONAL REQUIREMENTS (cont'd)

1. c. (3) Overvoltage and undervoltage monitoring shall be provided:

(a) An alarm condition signal shall exist for voltages greater than +32.0 volts dc ±3.0%.

(b) A no-go condition signal shall exist for voltages less than +22.0 volts dc ±3.0%.

2. Stage I

a. Stage I Flight Control Electronics

(1) +28 ±2 volts dc at the G&C umbilical connector at 0.5 to 1.5 amperes normal load.

(2) Ripple shall not exceed 200 millivolts rms or 500 millivolts peak-to-peak, as measured into a resistive load at the G&C umbilical connector.

(3) Overvoltage and undervoltage monitoring shall be provided:

(a) An alarm condition signal shall exist for voltages greater than +32.0 volts dc ±3.0%.

(b) A no-go condition signal shall exist for voltages less than +22.0 volts dc ±3.0%.

b. Stage I NCU Hydraulics

Undervoltage monitoring shall be provided:

a no-go condition signal shall exist for voltages less than +21.0 volts dc ±3.0%.

3. Stage II

a. AAU Heaters

(1) +28 ±3 volts dc at the pullaway umbilical connector including an interconnecting cable having characteristics as specified in ICD 25-26430 when the dc emergency voltage is greater than 29.0 volts; and +26 ±3 volts dc at the pullaway umbilical connector including an interconnecting cable having characteristics as specified in ICD 25-26430 when the dc emergency voltage is between 27.5 and 29.0 volts dc for a normal load of 0 to 2.4 amperes.

(2) Ripple shall not exceed 400 millivolts rms or 1 volt peak-to-peak as measured into a resistive load at the pullaway umbilical connector.

(3) Undervoltage monitoring shall be provided:

a no-go condition signal shall exist for voltages less than +23.0 volts dc ±3.0%.

b. AAU Electronics

(1) +28 ±2 volts dc at the G&C umbilical connector, at 0.5 to 1.5 amperes normal load.

FIGURE A NUMBER 13002
SHEET 3 OF 12

I. <u>TECHNICAL REQUIREMENTS</u> (cont'd)

A. <u>FUNCTIONAL REQUIREMENTS</u> (cont'd)

3. b. (2) Ripple shall not exceed 200 millivolts rms or 500 millivolts peak-to-peak as measured into a resistive load at the G&C umbilical connector.

(3) Overvoltage and undervoltage monitoring shall be provided:

(a) An alarm condition signal shall exist for voltages greater than +32.0 volts dc ±3.0%.

(b) A no-go condition signal shall exist for voltages less than +22.0 volts dc ±3.0%.

c. Stage II Flight Control Electronics

(1) +28 ±2 volts dc at the G&C umbilical connector at 0.5 to 1.5 amperes normal load.

(2) Ripple shall not exceed 200 millivolts rms or 500 millivolts peak-to-peak as measured into a resistive load at the G&C umbilical connector.

(3) Overvoltage and undervoltage monitoring shall be provided:

(a) An alarm condition signal shall exist for voltages greater than +32.0 volts dc ±3.0%.

(b) A no-go condition signal shall exist for voltages less than +22.0 volts dc ±3.0%.

d. Stage II TVCU Hydraulics

Undervoltage monitoring shall be provided:

A no-go condition signal shall exist for voltages less than +21.0 volts dc ±3.0%.

4. Stage III

a. Stage III Flight Control Electronics

(1) +28 ±2 volts dc at the G&C umbilical connector at 0.5 to 1.5 amperes normal load.

(2) Ripple shall not exceed 200 millivolts rms or 500 millivolts peak-to-peak as measured into a resistive load at the G&C umbilical connector.

(3) Overvoltage and undervoltage monitoring shall be provided:

(a) An alarm condition signal shall exist for voltages greater than +32.0 volts dc ±3.0%.

(b) A no-go condition signal shall exist for voltages less than +22.0 volts dc ±3.0%.

b. Stage III NCU Hydraulics

Undervoltage monitoring shall be provided:

A no-go condition signal shall exist for voltages less than +21.0 volts dc ± 3.0%.

I. TECHNICAL REQUIREMENTS (cont'd)

A. FUNCTIONAL REQUIREMENTS (cont'd)

5. Hydraulic Power Contactors Control

+23.1 to +26.2 volts dc at 0.1 to 0.7 amperes load each for two (2) contactors, as measured at the C225A output terminals.

6. Collimator Set, C21Q

a. 120 ±6 volts ac, rms, single phase at the input connector of the C21Q, with loads as described in ICD 25-26451.

b. 380 to 435 cycles per second under load conditions described in ICD 25-26451.

c. The harmonic content shall not exceed 20 percent up to a maximum frequency of 6000 cps and 0.5 percent above 6000 cps.

d. 200 ma rms maximum normal load, 50 ma rms minimum, of a non-sinusoidal repeating wave, nominally 400 cps, with no dc component.

e. Undervoltage monitoring shall be provided:

An alarm condition signal shall exist for voltages less than 110 ± 4 volts ac rms.

B. DESIGN CONSTRAINTS

The exceptions and/or deviations which are taken to applicable Design Constraints are listed and explained in Supplement I to this Figure A.

1. Power: The equipment shall be capable of operating from the DC emergency power source as defined in paragraph 3.2 of AFBSD Exhibit 62-77, dated 7 June 1962, revised 25 October 1962.

2. Physical: The equipment shall be packaged in a cabinet standardized for WS-133B.

3. Interface: An electrical interface is required between the equipment and the following:

a. Collimator Set, C21Q (Figure A, Item 602.3)

b. Signal Data Converter Set, C163A (Figure A, Item 13000)

c. DC Emergency Power Source

d. G & C Subsystems

(1) Guidance Set

(2) Stage I Flight Control

(3) Stage II Flight Control

(4) Stage III Flight Control

FIGURE A NUMBER 13002
SHEET 5 OF 12

I. <u>TECHNICAL REQUIREMENTS</u> (Cont'd)

B. <u>DESIGN CONSTRAINTS</u> (Cont'd)

4. Environmental: The equipment shall conform to applicable environmental requirements as defined in AFBSD 62-51 and 62-87.

5. Weapons Effect: The equipment shall conform to applicable weapons effects criteria as set forth in AFBSD Exhibit 62-83, as a design objective.

6. Monitoring: Operational malfunctions within the equipment shall be electrically monitored by the NS17 Missile Guidance Set (Figure A, Item 6275) utilizing status signals sent via the Signal Data Converter Set, C163A, (Figure A, 13000).

7. Operating Life: The operating life shall conform to the requirements specified in AFBSD Exhibit 62-58 paragraph 5.2.

8. Safety Considerations: The equipment shall conform to applicable safety requirements as defined in AFBSD Exhibit 62-82.

9. Special Considerations: Not applicable.

C. <u>OPERABILITY AND MAINTAINABILITY</u>

Operability and Maintainability requirements shall be compatible with the applicable portions of AFBSD Exhibits 61-99 and 62-53.

D. <u>RELIABILITY</u>

The reliability criteria shall conform to the applicable requirements as defined in AFBSD Exhibit 62-50, and Exhibit "R" of Letter Contract AF04(694)-247.

E. <u>APPLICABLE DOCUMENTS</u>

Deviations have been taken to those applicable paragraphs noted. The deviations and the reasons for these deviations will constitute a supplement to this Figure A. The approved deviations are to be incorporated by official addendum to the BSD Design Criteria Documents.

1. AFBSD Exhibit 62-50, dated 16 June 1962, titled Reliability Design Criteria. (Paragraph 4.4).
2. AFBSD Exhibit 62-84, not dated, titled Standardization Exhibit (Entirety)
3. AFBSD Exhibit 62-51, dated 12 June 1962, titled Environmental Design Criteria.
4. AFBSD Exhibit 62-53, dated 20 June 1962, titled Maintainability Exhibit. (Paragraph IV D)
5. AFBSD Exhibit 62-58, dated 11 June 1962, titled Design Criteria for WS-133B Guidance and Control Subsystem (Figure 2, Page 26, Paragraph 4.3.2.1.6, 4.3.3.2).
6. AFBSD Exhibit 62-75, dated 7 June 1962, titled Electrical Grounding Criteria (Paragraphs 2.1.2, 2.1.3, 2.1.4, 2.1.6, 2.3.2.2, & 2.4.4).

I. TECHNICAL REQUIREMENTS (cont'd)

E. APPLICABLE DOCUMENTS (cont'd)

6. AFBSD Exhibit 62-82, dated 15 May 1962, titled Weapon System Safety Criteria.
7. AFBSD Exhibit 62-87, dated 15 June 1962, titled Electro-Interference Compatibility Criteria. (Paragraph 1.1, 3.1.1).
8. AFBSD Exhibit "R" of Letter Contract AF04(694)-247.
9. AFBSD Exhibit 62-77, revised 25 October 1962, titled Power and Cabling Subsystem Design Criteria (Minuteman). Deviation to paragraph 3.3.1.4.1.
10. AFBSD Exhibit 62-83, dated 20 June 1962, titled WS-133B Weapons Effect Criteria.
11. AFBSD Exhibit 61-99, dated 1 February 1962, titled Human Engineering Design Criteria.

II. RECOMMENDED SOLUTION

It is recommended that an equipment, to be designated as the G&C Power Conversion Equipment (C225A), be designed and fabricated to fulfill the above requirements. The G&C Power Conversion Equipment will provide ground power to the following:

1. Airborne Guidance and Control Subsystem
2. Hydraulic Power Contactors
3. Collimator Set, C21Q, (Figure A, Item 602.3)

The G&C Power Conversion Equipment will consist of the following subassemblies:

1. Guidance Power Regulator Subassembly
2. Guidance Power Converter Subassembly
3. Control-Gyro Power Supply Subassembly
4. Electronic Power Converter Subassembly
5. Power Distribution Panel
6. Wire Harness Subassembly

A. FUNCTIONAL DESCRIPTION

To fulfill the functional requirements, the above listed subassemblies will be designed as follows:

1. Guidance Power Regulator Subassembly

II. **RECOMMENDED SOLUTION** (cont'd)

A. **FUNCTIONAL DESCRIPTION** (cont'd)

1. a. The regulator to provide regulated power to the DCU and IMU.

(1) The output voltage will be +28.0 ±1 VDC measured at the sense point, for all values of current within the normal defined range, except during the IMU turn on period.

(2) The ripple voltage will not exceed 300 millivolts rms and 1 volt peak-to-peak as measured into a resistive load at the G&C umbilical connector.

(3) The normal load will be 19 to 28 amperes for DCU and IMU, and 8.86 to 9.51 amperes for DCU only.

b. The electronics to detect out-of-tolerance conditions of the regulator and to transmit a status signal to the C163A, Signal Data Converter Set, (Figure A, Item 13000) at proper signal levels.

2. Guidance Power Converter Subassembly

a. The converter to provide isolated DC power to the Guidance Power Regulator Subassembly.

b. The electronics to convert the turn-on command received from the C163A, Signal Data Converter Set, (Figure A, Item 13000) to the level required to activate the subassembly power input contactor.

c. The electronics to detect out-of-tolerance conditions of the converter and to transmit a status signal to the C163A, Signal Data Converter Set, (Figure A, Item 13000) at proper signal levels.

3. Control-Gyro Power Supply Subassembly

a. The power supply to provide the gyros and fan motor starting overvoltage required during turn on of the IMU.

(1) The output voltage will be +39.5 to +45.0 VDC, measured at the G&C umbilical connector.

(2) The load will be 6.5 amperes average, superimposed with a 2 ampere peak-to-peak 2400 cps sawtooth variation.

(3) The Gyro Start power cycle will not be longer than 4 seconds. The output will be switched by a contactor activated on command from the C163A, Signal Data Converter Set (Figure A, Item 13000).

(4) The Gyro Start power will not be required at any time that Flight Control Electronics power is required.

b. The power supply to provide ground power to the AAU Electronics, CDU, and Stage I, II and III Flight Control Electronics.

(1) The output voltage will be +28 ±2 VDC, measured at the G&C umbilical connector.

II. RECOMMENDED SOLUTION (Cont'd)

A. FUNCTIONAL DESCRIPTION (Cont'd)

3. b. (2) The ripple voltage will not be greater than 200 millivolts rms and 500 millivolts peak-to-peak as measured into a resistive load at the G&C umbilical connector.

(3) The total norm load will vary from 5.0 to 9.0 amperes.

(4) The output will be switched by a contactor activated on command from the C163A, Signal Data Converter Set, (Figure A, Item 13000).

c. The electronics to convert commands received from the C163A Signal Data Converter Set (Figure A, Item 13000) to levels required to activate the power supply output contactors.

d. The electronics to detect out-of-tolerance conditions of the power supplies and to transmit status signals to the C163A. Signal Data Converter Set, (Figure A, Item 13000) at proper signal levels.

4. Electronic Power Converter Subassembly

a. The power supply to provide power to the Collimator Set.

(1) The output voltage will be 120 ± 6 volts ac, rms, single phase.

(2) The frequency will be 380 to 435 cps of a non-sinusoidal repeating wave, with 400 cps nominal and no dc component.

(3) The maximum normal load will be 200 ma rms. The minimum normal load will be 50 ma rms.

b. The regulator to supply power to the AAU Heaters.

(1) +28 ± 3 volts dc at the pullaway umbilical connector including an interconnecting cable having characteristics as specified in ICD 25-26430 when the dc emergency voltage is greater than 29.0 volts; and +26 ± 3 volts dc at the pullaway umbilical connector including an interconnecting cable having characteristics as specified in ICD 25-26430 when the dc emergency voltage is between 27.5 and 29.0 volts dc for a normal load of 0 to 2.4 amperes.

(2) The ripple voltage will be less than 400 millivolts rms and 1 volt peak-to-peak as measured into a resistive load.

c. The power supply to provide turn-on power to the two (2) hydraulic contactors upon command from the C163A.

(1) The output voltage will be +23.1 to +26.2 volts dc.

(2) The coil current will be 0.1 to 0.7 amperes for each contactor.

d. The power supply to provide power for use internal to the equipment.

e. The electronics to detect out-of-tolerance conditions of the power supplies and to transmit status signals to the C163A. Signal Data Converter Set, (Figure A, Item 13000) at proper signal levels.

II. RECOMMENDED SOLUTION (Cont'd)

A. FUNCTIONAL DESCRIPTION (Cont'd)

4. f. The electronics to detect out-of-tolerance conditions of the Stage I, II and III Hydraulic voltages and to transmit a status signal to the C163A, Signal Data Converter Set, (Figure A, Item 13000) at the proper signal levels.

5. Power Distribution Panel

a. The manually operated circuit breaker to switch the DC emergency power on and off to the regulator which supplies power to the AAU heaters and to interrupt this power in the event of a large overload (3 amperes).

b. The manually operated circuit breaker to switch the DC emergency power on and off to the G&C Power Conversion Equipment, excluding the AAU heater regulator, and to interrupt this power in the event of a large overload (140 amperes).

c. A connector receptacle for test points.

6. Wire Harness Subassembly

This subassembly will contain the necessary wiring and connectors to complete the inter-subassembly and subassembly to cabinet interfaces.

B. DESIGN DESCRIPTION

1. Power: The G&C Power Conversion Equipment will be designed to use input voltage that will vary between +37.7 and +27.5 volts dc from two (2) separate and electrically isolated power sources.

2. Physical: The (C225A) will be packaged in a GFE BAC C60B cabinet with necessary attachments and accessories.

3. Interface: The following cabling will be required to implement the electrical interface requirements.

a. A power cable from the DC power source. (Ref. ICD 25-38229).

b. A signal cable to the C163A, Signal Data Converter Set (Figure A, Item 13000) (Ref. AID 10016-111 and ICD 25-38229).

c. A power cable to the C21Q Collimator Set (Figure A, Item 602.3) (Ref. AID 10015-111 and ICD 25-38229).

d. Two (2) power cables to the missile. (Ref. AID 10014-111 and ICD 25-38229).

4. Environmental: The equipment will be designed to meet the following natural and induced environmental conditions which it must withstand during transportation, handling, storage, and use.

a. Air Conditioning - The equipment will be designed to operate when connected to an external source of cooling air having the following characteristics:

(1) Inlet temperature of +53°F to +57°F.

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

4. a. (2) Humidity, H = 105-3T/4, where H = relative humidity in percent and T = temperature (Fahrenheit). The outlet temperature will be +67°F maximum when the equipment is operating and supplied with the above cooling air.

b. Temperature Conditions -	
(1) Transportation and handling non-operating	-65°F to +150°F for periods up to 15 days
(2) Storage - non-operating	-40°F to +115°F for indefinite periods
(3) Operational area-operating	+60°F to +80°F
(4) Emergency temperature conditions	The equipment shall be capable of operating for a period of 6 hours while subjected to inlet cooling air temperature rising linearly from +70°F to +90°F during this period.
c. Altitude	
(1) Non-operating	Sea level to 50,000 ft.
(2) Operating	Sea level to 7,600 ft.
d. Humidity	
(1) Non-operating	0 to 95 percent relative humidity
(2) Operating	0 to 60 percent relative humidity
e. Vibration	
(1) Nonoperating	3.5 g rms, 5 to 50 cps (limited to 0.4 in. double amplitude) 1.5 g rms, 50 to 300 cps.
(2) Operating	5 g rms, 2 to 12 cps (limited to 6 in. double amplitude) 2 g rms, 12 to 2000 cps.
f. Shock	
(1) Non-operating	Shocks which may result in acceleration peaks of the order of 100 g.
(2) Operating	Not applicable.

FIGURE A NUMBER 13002
SHEET 11 OF 12

II. RECOMMENDED SOLUTION (Cont'd)

B. DESIGN DESCRIPTION (Cont'd)

4. g. Fungus

The equipment will be designed to withstand fungus growth occurring on nutrient organic materials, including contamination from grease, oils, dust, etc., for all conditions exceeding 60 percent relative humidity and 60°F. Growth is minimal below these limits.

h. Sand and Dust

The equipment will be designed to withstand sand and dust particles as encountered in desert areas under low velocity wind conditions.

i. Electro-Interference

The G&C Power Conversion Equipment will be designed to meet Electro-Interference Compatibility requirements as specified in AFBSD Exhibit 62-87 and 62-75.

5. Weapons Effect: The G&C Power Conversion Equipment will survive the conditions of pressure, shock, nuclear radiation, temperature, electromagnetic fields and acoustics resulting from attacks as defined in AFBSD Exhibit 62-83, as a design objective.

6. Monitoring: The individual power supplies within the G&C Conversion Equipment will be monitored and proper signals sent to the C163A, Signal Data Converter Set, (Figure A, Item 13000) upon detection of malfunctions.

7. Operating Life: The G&C Power Conversion Equipment will be designed to provide capability of three year operation.

8. Safety Considerations

a. Emergency shutdown will be accomplished by signals from the C163A, Signal Data Converter Set, (Figure A, Item 13000).

b. An external terminal on the cabinet will be provided for connection of a ground strap.

c. Circuit breakers are provided in the input power lines from the battery sets to prevent fusing of the wires and damage to the batteries.

9. Special Considerations: Not applicable.

C. OPERABILITY AND MAINTAINABILITY

Sufficient test points will be brought out to an external connector to aid and simplify fault isolation procedures.

D. RELIABILITY

In order to obtain greater assurance of meeting reliability requirements, maximum use of MINUTEMAN Standards Parts, solid state devices, and Military Standard Parts will be observed.

E. REFERENCE DOCUMENTS

Contractors applicable documents to be included at a later date.

TYPE OF LIST A OPERATIONAL GROUND EQUIPMENT	MODEL DESIGNATION B SM-80 WEAPON SYSTEM	SUB SYSTEM IDENTIFICATION C ENVIRONMENT	CONTRACTOR D THE BOEING COMPANY
FIGURE A NUMBER E 1209	MILITARY NOMENCLATURE AND FED. MFR'S CODE F	COMMON NOMENCLATURE G WATER CONTROL AND REMOVAL SYSTEM, LF	H ORIGINATION DATE 2-14-63 J AFBSD APP DATE 4-11-63 CONTRACT NO. K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	R FUNCTIONAL CLASS INDEX	M STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A requirement exists to control and remove waste water at the LF to support the operational capability of installed equipment. 2.58.2.1

A. Functional Requirements

Facilities shall be provided in the LEB, in the LEB access shaft, and in the Launcher to meet the following requirements:

1. Collect water seepage, equipment drainage, condensation and washdown water.
2. Transfer accumulated liquid waste to grade level. Normal high and low operating levels shall be sensed and a signal initiated to automatically start the transfer equipment.
3. Provision shall be made to sense a critically high liquid level in the Launcher Tube sump and in the LEB sump. This shall initiate an alarm signal to the C-163 signal data converter (Figure "A" 13000) and attempt to start the transfer equipment.
4. Prevent reverse flow in discharge lines.
5. Provision must be made to prevent blockage of the upper portion of the discharge system due to freezing.
6. The acidic drainage from the battery rack in the equipment room shall be neutralized before introduction into the disposal system.

REMARKS:
2.58.2.2
2.58.2.3
2.58.2.4
2.58.2.5
2.58.2.6
2.58.2.7
2.58.2.8
2.58.2.9
2.58.2.10
2.58.2.11
2.58.2.12
2.58.2.13
2.58.2.14
2.58.2.15
2.58.2.16
2.58.2.17

1. A. (Continued)

7. A gravity flow disposal shall be provided to convey the waste water at grade level from the Launch Facility Area to a remote location.

8. Provide protection against transmission of blast overpressure through discharge lines from the LEB and Launcher.

B. Design Constraints

1. Power

Electrical power requirements shall be for normal facility power and shall be provided during the pre-attack and the post-attack period.

2. Physical

Not applicable

3. Interface

An interface will occur with the following:

a. LF Electrical System (Figure "A" 1329).
b. C-163 Signal Data Converter (Figure "A" 13000).
c. Structure.
d. Shock mounted air conditioning unit
e. LEB shock attenuated platform.

4. Environmental

Not applicable

5. Weapons Effects

The waste water removal facility in the LEB and in the Launcher Tube shall be able to remain operable after the attack effects specified in the Facilities Criteria for WS-133B Launch Facility, Operational, D2-30081.

6. Monitoring

High water level alarm signal shall be electrically transmitted.

(Continued)

I. B. (Continued)

7. <u>Operating Life</u>

The operating life shall be 10 years.

8. <u>Safety Considerations</u>

Not applicable

9. <u>Special Considerations</u>

Not applicable

C. <u>Operability and Maintainability</u>

The cover of the tube sump shall incorporate a means for its convenient removal by maintenance personnel. This facility shall require a minimum of maintenance for the initial 3 year period. A means shall be provided to clean out the gravity drain line from the rattle space.

D. <u>Reliability</u>

E. <u>Applicable Documents</u>

1. Facilities Criteria for WS-133B D2-30081.

2. BSD Exhibit 62-83, Weapons Effects Criteria.

II. RECOMMENDED SOLUTION

A. A sump that is an integral part of the LEB will be the collection point for all liquid wastes from the LEB. A pump will transfer the wastes through a hardened discharge pipe to grade level for disposal and will be automatically controlled by a level sensing device.

The pump and its controls will be shock mounted as necessary to remain operable after an attack.

(Continued)

II. A. (Continued)

An additional level switch will sense a critically high liquid level in the sump and initiate a signal to the C-163 Signal Data Converter (Figure "A" 13000) and also energize the pump starter.

B. A sump that is an integral part of the Launcher Tube foundation will be located near the tube wall and off the centerline of the missile mounting system. It will be the collection point for all liquid wastes from the Launcher Tube.

A pump, automatically controlled by a level sensing device, will transfer the Launcher Tube liquid waste through an independent hardened discharge line to Grade Level for disposal. Additional control equipment will sense a critically high liquid level in the sump and will initiate a signal to the C-163 Signal Data Converter (Figure "A" 13000) and at the same time will energize the pump motor starter. A check valve will be located in the discharge line. The transfer facility and control equipment will be shock mounted as necessary to remain operable after an attack.

A neutralizing basin, filled with marble chips, will be located in the lower level floor of the Launcher equipment room to collect the waste from battery washdown. The wastes from the air handling unit will be conveyed by gravity to the neutralizing basin. Any seepage from the equipment room rattle space and the overflow from the neutralizing basin will be transferred by gravity through a drain line to the launcher tube sump.

C. A sump that is an integral part of the LEB access shaft floor will collect the seepage into the access shaft. A pump, automatically controlled by a level controller, will be installed in the sump. A check valve will be installed in the discharge line. The check valve will have a 1/4-inch hole drilled in the flapper to drain the discharge line on the off cycle of the pump to prevent blocking of the line due to freezing. A level sensing device will sense a critically high level in the sump, and will initiate a signal to the C-163 Signal Data Converter parallel to the signal from the LEB sump.

D. The discharge lines from the three pumps will join a common header located in the access shaft. In this line, downstream from the junction, a check valve will be installed. The valve flapper will be drilled as described above. A shock attenuation device will be installed in the line immediately downstream from the check valve. The common discharge line will be routed to an above Grade drainage ditch.

(Continued)

II. (Continued)

E. The system will contain the following equipment:

1. Liquid transfer pump and starter, 208 volts, 3 phase, 60 cycles (Launcher Tube).
2. Liquid transfer pump and starter, 480 volts, 3 phase, 60 cycles (LEB).
3. Liquid transfer pump and starter, 480 volts, 3 phase, 60 cycles (LEB access shaft).
4. Level controls (three required).
5. Check valve (four required).
6. Neutralizing basin.
7. Pipe and fittings.
8. Liquid line shock attenuator.

NOTE

This Figure "A" is similar to Figure 1209.3 except for changes to meet the new WS-133B Weapons Effects Criteria.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C LIFE SUPPORT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	J AFBSD APP DATE	CONTRACT NO.
E 1210	F	G SEWAGE DISPOSAL SYSTEM, LCF	2-14-63	5-8-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	APPROVAL DATE 4	B FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
...-63	A	STL Review	...-63						1											RPIE			W-6	2.54.38 2.54.38.1 2.54.38.2 2.54.38.3 2.54.38.5 2.54.38.6 2.54.38.7 2.54.38.8 2.54.38.9 2.54.38.10 2.54.38.11 2.54.38.12 2.54.38.13 2.54.38.14 2.54.38.15 2.54.38.16 2.54.38.17

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists for the collection, removal, and disposal of sewage and liquid waste from the LCF The sewage disposal system shall satisfy the following requirements:

1. A permanently installed gravity collection system shall be provided for the LCSB. Fixture connections shall be provided, as required, in the kitchen, toilet room, and utility room. Means of transferring raw water from the water treatment room to the collection system is required.

2. Means must be provided to collect and automatically transfer sewage and incidental liquid waste from the LCC. Fixtures and connections shall be provided in the LCC for sanitary collection of human waste and for personal washing capability.

3. A provision must be made for emergency storage of sewage and liquid waste in the LCC for post-attack and post-launch periods. A provision shall be included to allow evacuation of emergency storage facility, if inadvertently filled during normal period.

4. There is a requirement to protect the LCC from outside environment.

   a. The sewage line shall be provided with a shock actuated, automatically operated device located at point of shell penetration to prevent ground water and CBR intrusion due to broken or damaged drain line. Means shall be provided for manual closure of the sewage line and also the vent line covered under A4c.

(Continued)

I. A. 4 (Continued)

b. A shock attenuation device shall be provided to protect the LCC from blast overpressure.

c. The vent line shall be provided with a shock actuated, automatically operated device located at point of shell penetration to prevent inflow of ground water or CBR intrusions due to broken or damaged pipe. Upon vent closure, venting function shall be automatically assumed by an auxiliary interior vent equipped with an odor absorption device.

d. The normal vent line shall be designed to preclude blast overpressure transmission to the capsule.

5. Means must be provided to collect and automatically remove incidental liquid waste from the LCEB during the pre-attack period.

6. There is a requirement to protect the LCEB from outside environment.

a. The liquid waste line shall be provided with a protective closure device to prevent ground water intrusion due to broken or damaged discharge line.

7. Means for removing incidental liquid waste from the tunnel junction area and elevator pit during the pre-attack period shall be provided.

Provide a hardened sewage collection facility for sewage and waste from the LCC and LCEB. A critically high liquid level alarm signal shall be monitored in the LCC(Figure "A" 1396).

Means shall be provided to automatically transfer sewage and liquid waste from the collection facility to the above grade disposal point during the preattack period.

Means shall be provided in the sewage pump discharge line to prevent reverse flow of sewage.

8. A remotely located facility is required to receive and dispose of all collected sewage wastes from the LCF. It shall be sized for sufficient detention to satisfy BOD requirements for normal sewage decomposition. Provision shall be made for controlled overflow and for maintaining a minimum liquid depth.

(Continued)

I. (Continued)

B. **Design Constraints**

1. **Power**

The equipment comprising the sewage disposal system shall operate on facility power.

2. **Physical**

Not applicable

3. **Interface**

The sewage disposal system will interface with the following systems:

a. Water Supply System, LCF (Figure "A" 1324).
b. Electrical System, LCF (Hard) (Figure "A" 1323).
c. Electrical System, LCSB (Figure "A" 1437).
d. Shock Attenuation System, LCC (Figure "A" 1241).

4. **Environmental**

a. Ambient

Gravity lines must be protected from freezing.

b. Dynamic

The sewage system components within the LCC shall withstand induced shock conditions and remain operable post blast.

5. **Weapons Effects**

The hardened sewage collection facility shall withstand the blast induced overpressure as specified in D2-30082 Facilities Criteria for WS-133B Launch Control Facility, Operational.

(Continued)

I. B. (Continued)

6. Monitoring

A critically high level in the hardened sewage collection facility must be electrically transmitted for monitoring.

7. Operating Life

The sewage disposal system shall be capable of operating for a 10 year period with minimum maintenance.

8. Safety Considerations

Not applicable

9. Special Considerations

Not applicable

C. Operability and Maintainability

1. Any check valve shall be accessible for cleanout purposes.
2. All lines shall be routed through tunnel junction area and elevator shaft where possible, to secure maintainability during pre-attack period.
3. Pumps shall be readily accessible for maintenance or repair.
4. A means of maintaining a minimum level in the sewage lagoon shall be provided.

D. Reliability

E. Applicable Documents

1. D2-30082 Facilities Criteria for WS-133B Launch Control Facility, Operational.

(Continued)

I. E. (Continued)

2. BSD 62-83 Weapon Effects Criteria.

II. RECOMMENDED SOLUTION

It is recommended that an interconnected system that will collect and remove all liquid and solid sewage waste from the LCF Site be provided. A sewage disposal system will be provided as follows:

A. A gravity flow waste system will be provided in the LCSB. It will consist of floor sinks, floor drains, cleanouts, piping, and necessary traps. Connected service will be provided for fixtures in the kitchen, fixtures in the toilet room, the drinking water dispenser in the hallway, and the clothes washer in the utility room. Drains will be provided from the booster water heater relief valve, the kitchen sink, and the dish washer to open discharge into a floor sink in the kitchen. A floor sink will be provided in the water treatment room which will also be used as a means of transferring raw water to the sewage lagoon (refer to Water Supply System, LCF, Figure "A" 1324).

B. A gravity flow sewage removal system will be provided in the LCC. It will consist of a floor drain with a backwater valve, a lavatory with a drinking water bubbler, and a water closet. A diversion device will be provided to divert sewage flow from the lavatory and water closet, during post-attack and post-launch periods, to an emergency storage tank within the LCC. The tank will be sized to contain sewage for the combined post-attack and post-launch periods.

C. The following provisions will be made to protect the LCC against outside environment:

1. At the sewage line penetration point a shock actuated, automatically operated valve will be installed to protect the LCC against reverse flow and CBR agents. A hardened sewage sump serving as a shock attenuator and the configuration of the sewage system will attenuate the blast overpressure. A switch on the Monitor and Alarm Panel will also initiate valve closure.

2. At the vent line penetration point a shock actuated, automatically operated valve will be installed to provide positive protection against reverse flow and CBR agents. When the valve is closed, venting will be accomplished by an auxiliary interior vent equipped with an odor absorption device. Actuation of the vent valve will parallel that of the sewage closure valve.

(Continued)

II. C. (Continued)

3. The exterior vent pipe used during the normal period will be routed from the LCC to above grade in a manner required to attenuate blast overpressure.

D. A gravity flow liquid waste system will be provided in the LCEB. It will consist of a sump into which drains all accumulated water seepage and drainage from the standby diesel generator and brine chiller. The sump drain line will be equipped with a spring actuated, normally closed valve that must be manually opened and which closes automatically when released.

E. A sump and sump pump will be provided in the bottom of the elevator shaft. The sump pump discharge line will be connected to the gravity sewer line leading to the disposal facility. Gravity drain lines from the interconnecting tunnels will discharge into the elevator shaft sump. The tunnel junction floor will drain into the elevator shaft. A check valve will be installed in the pump discharge line to prevent reverse flow. Pump control is by a manual switch in the tunnel junction.

F. A covered sewage collection sump will be provided to receive sewage waste from the LCC and the LCEB. The collection sump will be located in the tunnel junction. The sump will be designed as an attenuation chamber in order that blast overpressure through gravity lines from the LCC and LCEB will not exceed desired limits.

An automatically controlled sewage pump will be installed in the collection sump. The pump discharge line will empty into a gravity sewer line leading to the disposal facility. A check valve will be installed in the sewage pump discharge line in the hardened sump downstream of a frangible connection to prevent reverse flow.

A level sensing system will be provided. An air bubbler line from the water system air compressor will be extended into the collection sump. A control panel will be located in the tunnel junction area. The system pressure switches for high and low level pump control and critically high level alarm will be located in the control panel.

G. A sewage lagoon will be provided to dispose of the sewage waste generated in the LCF. It will be located approximately 200 feet from the LCSB. It will fulfill BOD requirements by using a minimum liquid level of 3 feet. An overflow pipe will be used to limit the surface water level at 5 feet.

H. The system will contain the following equipment:

1. LCC water closet.

2. LCC lavatory with drinking water bubbler.

(Continued)

II.H. (Continued)

3. Flow diversion device
4. Sewage line valve with pneumatic closure device.
5. Vent line valve with pneumatic closure device.
6 Three-way solenoid operated valve.
7. Shock actuated switch.
8. Toggle switch on LCC Monitor and Alarm Panel.
9. Source of regulated compressed air.
10. Conservation vent with odor absorption filter.
11. Storage tank with access cover.
12. Drain valve for storage tank.
13. Flexible hoses, five each.
14. Hardened collection sump and cover.
15. Sewage sump pump with magnetic starter (480 volts, 3 phase, 60 cycles).
16. Check valve.
17. Frangible connection.
18. Spring actuated valve for LCEB drain.
19. Waste water sump pump with magnetic starter (480 volts, 3 phase, 60 cycles).
20. Check valve.
21. Control panel with manual and automatic level controls.

II. H. (Continued)

22. Fixture connections and floor drains in the LCSB.

23. Sewage lagoon.

24. Piping and associated fitting.

NOTE

This Figure "A" is similar to Figure "A" 1210.3 except for changes to meet the new WS-133B Weapons Effects Criteria.

SHEET 8 OF 8 NOMENCLATURE SEWAGE DISPOSAL SYSTEM, LCF FIGURE A NUMBER 1210

2-68340-6

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 1217	F	G CLOSURE, LAUNCHER TUBE	2-14-3	K AF 04(694)-266
			J AFBSD APP DATE 4-11-63	

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-[illegible]	A	STL Review	4-11-63					1						6						RPIE			W6	2.58.3.12 2.58.3.13 2.58.3.14

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide a mobile hardened closure for the Launcher Tube. The closure will have a rapid opening mode for missile launch and a slower opening/closing mode for missile emplacement, removal and maintenance. The closure will resist direct or induced effects of nuclear blast and climatic conditions. The closure will tolerate the static and dynamic loads imposed by the range of operating conditions. The closure will be provided with security and monitoring facilities.

B. Design Constraints

1. Power

a. Gas generator powered device for closure actuation in launch mode.
b. Hydraulic system for closure actuation in maintenance mode.
c. Electrical power supply for operation of portable hydraulic pusher set (Figure "A" 4640) (MGE).

2. Physical

a. Design concept for closure will be identical to the WS-133A Figure "A's" with modifications limited to those required to accommodate the specific criteria of WS-133B Wing VI configuration:

(Continued)

I. B. 2 (Continued)

b. The Launcher closure will consist of the following integrated elements:

(1) Launcher closure structure.
(2) Bearing area to support closure and seal Launcher Tube.
(3) Maintenance opening/closing power units.
(4) An apron for tracks and gear rack for closure travel.
(5) Scraper for clearing path of closure travel.
(6) Environmental seal.
(7) Electromagnetic shielding.

See D2-30081.

c. The Launcher closure will tolerate the following loads:

(1) Static loads due to deadweight of closure.
(2) Dynamic loads resulting from prescribed weapon effects.
(3) Operational loads as follows:

(a) Static and sliding friction.
(b) Rolling frictional resistance of wheels.
(c) Breakaway under severe climatic conditions and post-attack debris.
(d) Reaction loads of wheel mounts and actuating mechanism.
(e) Loads of maintenance opening/closing.

See D2-30081.

(Continued)

I. B. (Continued)

3. <u>Interface</u>

a. The Launcher closure will interface with the following elements:

(1) Actuating and Locking Mechanism ATU-26/E, Launch Closure.
(2) Hydraulic pusher set, (Figure "A" 4640).
(3) Security System, LF (Figure "A" 1331).
(4) Alarm Set, Anti-Intrusion, Restricted Area AN/GSQ-54.

4. <u>Environmental</u>

a. <u>Ambient</u>

The Launcher closure will resist all degrading effects of climatic conditions and maintain an effective seal of the Launcher Tube controlled ambient environment.

See D2-30081.

b. <u>Dynamic</u>

The Launcher closure will be capable of resisting ground shock in all planes and blast pressures, individually or simultaneously and follow-up vacuum effects.

See D2-30081.

5. <u>Weapons Effects</u>

a. Ground shock and blast pressures (see Response Spectra D2-30081).

b. <u>Radiation</u>

The Launcher closure will resist the degrading effects of nuclear radiation, thermal radiation, and electromagnetic radiation and attenuate them to acceptable levels.

See D2-30081.

(Continued)

I. B. (Continued)

6. Monitoring

The positional status of the Launcher closure will be monitored.

See D2-30081.

7. Operating Life

See D2-30081.

8. Safety Considerations

a. Provisions for safety will be made during maintenance operation of the Launcher closure.

See D2-30081.

9. Special Considerations

a. Direction of Launcher closure travel to be opposite to transporter-erector in emplaced position and coincident with centerline of hardstand.
b. Launch mode closure opening time to be a maximum of 5 seconds.
c. Maintenance mode open/close cycle may be a maximum of 20 minutes.

See D2-30081.

d. For finishes see D2-30081.
e. Locking will be provided to prevent inadvertent opening of the closure from prescribed weapon effects.
f. The Launcher closure will be capable of containing missile in Launcher Tube under condition of inadvertent firing.

C. Operability and Maintainability

D2-30081.

(Continued)

I. (Continued)

D. Reliability

E. Applicable Documents

D2-30081 Facilities Criteria WS-133B Launch Facility, Operational.

II. RECOMMENDED SOLUTION

A. It is recommended that a mobile hardened closure be provided for the Launcher Tube. The Launcher closure will protect the missile and launch equipment and will be integrated with operational, maintenance, security and monitoring functions. Particular elements of the Launcher closure are defined as follows:

1. Launcher Closure

The closure will be a reinforced-concrete monolithic slab. Structural embedments for mounting and attachment of actuating and locking mechanisms and related control and sensing circuitry, wheel trucks, seals, shielding plate and load bearing ring will be incorporated into the structure.

2. Wheels and Tracks

The Launcher Closure is fitted with four 18-inch diameter wheels rolling on two steel track units. In closed position, wheels will be disengaged from tracks, by means of track recesses, to allow machined load bearing rings to engage machined load support surfaces on the apron. On open cycle, the closure weight is transferred to the wheels after approximately 4 inches of forward travel. The wheels ride on tracks embedded in the equipment room roof and on cantilevered beams. The cantilevered beams will be designed to withstand loads resulting from prescribed weapons effects. The wheel assemblies and tracks are designed to withstand static, dynamic and impact loads resulting from the operational opening stroke or prescribed weapons effects. The rolling coefficient of friction is approximately 0.05. Maintenance operation will be provided by a hydraulic pusher set (Figure "A" 4640).

(Continued)

II. A (Continued)

3. **Bearing Rings**

The weight of the closure in the closed position is supported by a bearing area provided by two machined bearing rings. One of these bearing rings is in the bottom of the closure and the mating ring is mounted on top of the equipment room roof surrounding the Launcher Tube. The bearing rings are designed to effectively withstand static, dynamic, breakaway and reaction loads resulting from operational, climatic or prescribed weapons effects. The bearing rings are provided with a lubricant selected to obtain coefficients of static and sliding friction not greater than 0.5 and 0.2 respectively. The lubricant will maintain the electromagnetic shielding continuity.

4. **Electromagnetic Shielding**

The bearing ring in the equipment room roof slab is machined to receive a continuous, compressible, conductive contactor consisting of a 40 durometer, monel-mesh-encased, neoprene gasket which provides shielding continuity and minimizes, to safe levels, intrusion of degrading atmosphere due to blast pressure into the Launcher Tube. The invert side of closure is provided with a steel liner plate with continuous welded seams at all joints to complement Launcher electromagnetic shielding.

5. **Environmental Seal**

The Launcher Tube is sealed against climatic conditions by two removable seals. One is a scraper seal attached to the front of the closure and is designed to clear a post-attack debris load of approximately 100 pounds per cubic foot to insure unobstructed closure travel. The other seal is a compressible gasket between the movable closure and the equipment room roof slab. The total breakaway force of this seal is 10,000 pounds. This seal is not designed to survive a weapons attack. The combination of the hardened concrete closure and environmental seals effectively protects the missile and launch equipment from climatic conditions and radiation effects of nuclear attacks.

B. The Launcher closure will consist of the following equipment:

1. Reinforced-concrete monolithic closure.
2. Four wheel truck assemblies.

(Continued)

II. B (Continued)

3. Two operational track units.
4. Maintenance gear rack unit.
5. Two matched load bearing rings.
6. Environmental seals.

NOTE

This Figure "A" is identical to Figure "A" 1217. All other elements of the Launcher closure to be supplied by others.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	2-14-63	CONTRACT NO
E 1230	F	G FUEL SYSTEM, LCSB	J AFBSD APP DATE	4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-14-63	A	STL Review	4-11-63						1											RPIE			W-6	2.53.3.2

I. TECHNICAL REQUIREMENTS

A requirement exists to supply fuel to the LCSB to support operation of the standby generator unit, and the Heating System (Figure "A" 1437 and 1325). A system shall be provided to fulfill the following requirements:

A. Functional Requirements

1. Underground bulk fuel storage is required. The bulk storage facility shall have sufficient capacity to sustain normal operation of the hot water heating system for a period of 60 days. The amount of fuel in storage shall be sensed and transmitted to a level indicating device located in the LCSB. A means is required for filling the bulk fuel storage facility at Grade Level from an accessible location.

2. The fuel facility for the LCSB is required to supply the needs of the engine of the standby power unit and the boiler of the heating system. Provision shall be made for the return of excess fuel from both units to the bulk storage facility.

B. Design Constraints

1. Power

Not applicable

2. Physical

Not applicable

(Continued)

I. B. (Continued)

3. <u>Interface</u>

a. <u>Physical</u>

The supply and return fuel lines interface with the boiler of the Heating System and the standby generator set.

b. <u>Electrical</u>

Not applicable

4. <u>Environmental</u>

Not applicable

5. <u>Weapons Effects</u>

Not applicable

6. <u>Monitoring</u>

Not applicable

7. <u>Operating Life</u>

The bulk storage facility shall have a minimum operating life of 10 years.

8. <u>Safety Considerations</u>

Vent shall terminate a minimum of 2 feet above roof of LCSB at eaves.

9. <u>Special Considerations</u>

Not applicable

(Continued)

I. (Continued)

C. Operability and Maintainability

1. The bulk storage tank shall be readily filled through its fillpipe at an accessible location at Grade. Water or fuel shall be pumped from the tank by means of a drop (suction) line in the fillpipe.

2. The fuel level in the tank shall be indicated on a device in the LCSB.

D. Reliability

E. Applicable Documents

D2-30082 Facilities Criteria for WS-133B Launch Control Facility, Operational.

II. RECOMMENDED SOLUTION

It is recommended that a fuel system be installed for the Launch Control Support Building to supply fuel for standby diesel generator and to the hot water heating system. A system will be provided as follows:

A. A cylindrical storage tank will be installed horizontally below Grade. A fillpipe with locking type fill cap will extend into an accessible manhole with a watertight cover flush with Grade. A vent pipe will terminate with a pressure and vacuum conservation vent 2 feet above the LCSB roof at eaves. The storage tank shall be equipped with a liquid level transmitter located in an accessible Grade Level manhole with watertight cover and connected by tubing to an indicating gage in the LCSB utility room.

B. Supply piping will be connected from the tank to the boiler in the utility room and to the engine of the diesel generator in the generator room. The tank fuel supply suction risers will each be provided with an extractor type foot valve and strainer which is removable from an accessible Grade Level manhole with watertight cover. Return piping will be routed to the storage tank from both locations.

(Continued)

II. (Continued)

C. The system will contain the following equipment:

1. Bulk storage tank.
2. Fillpipe with locking type fill cap in manhole with watertight cover.
3. Liquid level transmitter in manhole with watertight cover and level indicating gage.
4. Conservation pressure and vacuum vent valve.
5. Two suction foot valve and strainer extractor installations.

NOTE

This Figure "A" is similar to Figure "A" 1230.3 except for addition of extractors and liquid level transmitter manhole.

TYPE OF LIST
A REAL PROPERTY INSTALLED EQUIPMENT

MODEL DESIGNATION
B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION
C ENVIRONMENT

CONTRACTOR
D THE BOEING COMPANY

FIGURE A NUMBER
E 1241

MILITARY NOMENCLATURE AND FED. MFR'S CODE
F

COMMON NOMENCLATURE
G SHOCK ATTENUATION SYSTEM, LCC

H ORIGINATION DATE 2-14-63

J AFBSD APP DATE 4-11-63

CONTRACT NO.
K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
[illegible]	A	STL Review	4-11-63						1					3						RPIE			W-6	2.53.2.3 2.53.2.4 2.53.2.5 2.53.2.6 2.53.2.7 2.53.2.8

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide an isolated structure for shock sensitive equipment and personnel in the LCC, including special shock mounting assemblies and flexible interconnections.

B. Design Constraints

1. Power

Not applicable.

2. Physical

a. A structural steel, shock-isolated platform is required to provide shock protection for shock-sensitive weapon system equipment and personnel stationed in the LCC. The platform will be sized to accommodate mounting provisions and space for the following:

(1) Motor-generator set.
(2) Monitor and Alarm Panel.
(3) Command Control Console.
(4) Status Monitor and Launch Enable Console.
(5) Medium frequency transmitter and receiver.
(6) Antenna tuner unit.
(7) Regulated Power Distribution Panel.
(8) Signal junction rack.

(Continued)

I. B. 2. a. (Continued)

(9) Communication cable equipment.
(10) HF/UHF.
(11) Voice and data terminal.
(12) Message authentication unit.
(13) $465L_c$ data transfer.
(14) 465L data converter.
(15) 465L data analysis.
(16) 465L indicator.
(17) 465L transfer.
(18) 465L crypto.
(19) 465L converter.
(20) Four-drawer lock safe.
(21) Unidentified system.
(22) Cable termination equipment.
(23) System 279.
(24) Primary Alert System.
(25) System 487.
(26) 160-volt battery charger.
(27) 32-volt battery charger.
(28) Drinking fountain and wash basin.
(29) Oven and refrigerator unit.
(30) Bunks (built-in).
(31) Freezer.
(32) Life Support Air System.
(33) Electric Power Panel.
(34) Heating and Ventilation Panel.
(35) Water closet.
(36) Air-conditioning unit.
(37) Fire extinguishers.
(38) Batteries.
(39) Survival food.
(40) Cable trays and cables.
(41) Ducts and sound traps.
(42) Piping and fittings.
(43) Operators seats.
(44) Battery Disconnect switch.
(45) Shock isolators.
(46) Air bottles.
(47) Platform.

(Continued)

I. B. 2. a. (Continued)

(48) Support attachments for suspension system.
(49) Access for maintenance and MGE to equipment mounted on isolated platform structure and adjacent fixed structures.
(50) See D2-30082.

b. Flexible interconnections for all system interconnections between rigid mounted equipment/junctions and isolated platform structure. They will be sufficiently flexible to introduce no significant restraint to the motion of the platform. Connections are required for the following:

(1) Environmental control ducting.
(2) Electrical distribution conduits.
(3) Fluid transmission piping.
(4) Communication and antenna cables.

c. The following miscellaneous items attached to the hardened structure require special shock mounting assemblies:

(1) Lighting fixtures.
(2) Hardened communication cables.
(3) Hardened electrical conduits.

3. Interface

The Shock Attenuation System will interface with the following:

a. LCC hardened structure.
b. Weapon system equipment.
c. Emergency batteries.
d. Shielded enclosure in the LCC.
e. Shock isolators.
f. Pressurized cable system.
g. LCF grounding system (see D2-30082).

4. Environmental

a. Ambient

The Shock Attenuation System will resist all degrading effects of ambient conditions (see D2-30082).

(Continued)

I. B. 4. (Continued)

b. Dynamic

The Shock Attenuation System shall withstand without damage, the maximum ground shock motions arising from specified weapons effects (see D2-30082).

5. Weapons Effects

For ground shock, see Response Spectra D2-30082.

6. Monitoring

Not applicable.

7. Operating Life

See D2-30082.

8. Safety Considerations

Not applicable.

9. Special Considerations

For finishes, see D2-30082.

C. Operability and Maintainability

See D2-30082.

D. Reliability

E. Applicable Documents

D2-30082, Facilities Criteria for WS-133B Launch Control Facility, Operational.

(Continued)

II RECOMMENDED SOLUTION

It is recommended that a system be provided to protect the weapon system equipment and personnel in the LCC from intolerable forces resulting from ground shock. The integrated system will provide protection as follows:

A. A shock attenuated platform will be suspended in the LCC, in a plane with the access floor. Platform will include space for equipment, maintenance and MGE, as follows:

1. A structural platform with allowance for vertical and horizontal rattle space and hinged bridge plates for access and to provide floor continuity.

2. Mounting brackets will be attached to the hardened wall and on the attenuated platform. Wall brackets will include provision for vertical travel of platform to the limits of vertical isolators. The platform brackets will also complement this function. All brackets will be compatible with shock isolator set (Figure "A" 1421).

B. All lighting fixtures, not attached to shock isolated platform, will be provided with tension spring hangers.

C. All system interconnections will be flexible to shock isolated equipment/components as follows:

1. All interconnections of hard mounted environmental ductwork and shock isolated equipment will be flexible duct/connector type.

2. All interconnection of hard mounted electrical transmission media and shock isolated Equipment/ Electrical Panels will be flexible conduit type.

3. All interconnection of hard mounted fluid transmission media and shock isolated equipment will be flexible hose type.

D. The hardened communication cable (Figure "A" 1402.6) and hardened antenna cable (Figure "A"). will be protected from shock effects at entrance to LCC. The case will be anchored at outer wall of penetration and will envelope the conduit outboard for a designed distance, to provide support in the transition from motion of the structure to motion of the ground.

E. The Shock Attenuation System will consist of the following equipment:

1. Structural mounting platform.

2. Wall brackets.

(Continued)

II. E. (Continued)

3. Shock mounting for hard mounted lighting fixtures.

4. Flexible ducts and connections.

5. Flexible conduit and connections.

6. Flexible hose and connections.

NOTE

This Figure "A" is similar to Figure "A" 1241.3, except for basic revisions resulting from a new equipment layout and increased building size.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	BSM-80 WEAPON SYSTEM	C LIFE SUPPORT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE / AFBSD APP DATE	CONTRACT NO.
E 1242	F	G LIFT, SERVICE, LCF	H 2-14-63 / J 5-8-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	B FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	5-8-63						1					3						RPIE			W-6	2.54.19

1. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide a service lift in the soft access shaft which connects the LCSB to the hardened underground facilities. The service lift shall provide transportation for personnel and equipment between Grade Level and the LCF tunnel junction.

The service lift requires operating and control facilities, including a call station at the upper and lower landings, and a dispatch station located within the lift car.

B. Design Constraints

1. Power

480-volt, 3-phase, 60-cycle power shall be available at all sites.

2. Physical

a. The lift shall have a live load capacity compatible with the heaviest equipment module installed in the underground facility.
b. The inside dimensions of the lift car shall be compatible with the largest equipment module installed in the underground facility plus an operator.

3. Interface

The service lift shall interface with the following RPIE:

a. The soft access shaft, including the upper and lower accessways.
b. Electrical System, LCF, Figure "A" 1323.

(Continued)

I. B. (Continued)

4. Environmental

a. Ambient

The service lift is required to operate in an ambient environment as referenced in D2-30082.

b. Dynamic

The service lift hoisting components shall tolerate the dynamic forces imposed by the maximum hoisting requirement.

5. Weapon Effects

The service lift is not required to tolerate weapon effects.

6. Monitoring

Service lift usage shall be sensed and displayed on the Call Station Panel at each landing.

7. Operating Life

The service lift shall be designed for an operating life of 10 years with minimum maintenance and/or servicing as specified in D2-30082.

8. Safety Considerations

a. Safety closures shall be provided at each landing entry and in the lift car which prohibit the movement of the car, when open. Provisions shall be incorporated which prohibit opening of the entry closures when the car is not at the landing.
b. Spring buffers shall be installed in the bottom of lift shaft to attenuate the kinetic forces imposed in the event of a free fall of the lift car.
c. Control equipment shall be incorporated to accomplish the following safety requirements:

(1) Stop the lift car level with the landing.
(2) Accelerate the car smoothly away from the landing.
(3) Stop the motion of the car in the event of a slackening of the lift cables.
(4) Stop the car in the shaft, in a minimum distance, in the event of car overspeed.
(5) Disconnect line current in the event of car overtravel.

(Continued)

I. B. 8. (Continued)

d. All safety equipment shall be of the fail-safe type and shall conform to safety standards as enumerated in the American Standard Safety Code for Elevators, Dumbwaiters and Escalators (ASA-A17.1-1960).

9. Special Considerations

a. An independent control station is required on top of the lift car, for the use of maintenance personnel. The control station shall incorporate safety overriding controls.
b. A means of emergency/maintenance access to the top of the lift car is required from within the car.
c. The lift car shall be illuminated.
d. Structural components shall conform to the standards established by ASA-A17.1-1960.
e. Finish, marking, color and corrosion control shall conform to the criteria referenced in D2-30082.

C. Operability and Maintainability

The service lift shall utilize the concepts defined in D2-30082.

D. Reliability

E. Applicable Documents

1. D2-30082 Operational Facilities Criteria for WS-133B, LCF.
2. D2-14119, Volume II, S-133-11-0-3, WS-133A OGE Figure "A"'s.
3. ASA-A17.1-1960 American Standard Safety Code for Elevators, Dumbwaiters and Escalators.

(Continued)

II. RECOMMENDED SOLUTION

It is recommended that an electrically driven service elevator be provided to transport personnel and equipment between the surface entry of the accessway to the hardened facilities. The elevator will operate on 480-volt alternating current and will utilize 120-vdc control power and will incorporate the following:

A. The elevator will have a rated capacity of 9000 pounds, exclusive of the weight of the car and the cables.

B. The car will travel at a speed of 25 feet per minute. Car speed will not vary more than ±10 percent of rated travel when the elevator is loaded to capacity.

C. Clear head room in the elevator cab will be 8 feet, 3 inches. The entrance width of the cab will be 6 feet, 4 inches, and the cab will be at least 11 feet deep, front to back. A personnel access hatch will be provided in one of the cab panels for maintenance purposes.

D. The elevator will utilize noncounterweighted hoisting equipment. A controller panel will be mounted in the lift machine area. The elements of the controller will be connected to govern direction, accerlation, running, retarding and stopping of the hoisting motor. A single wall cabinet with front access will house motor and brake control equipment. UP and DOWN contactors to reverse direction of motor rotation will be mechanically interlocked to prevent simultaneous operation. All contactors shall be the self-wiping type. All parts will be readily accessible for maintenance or replacement. Limit switches will be provided at each landing to prevent overtravel of car. Final limit switches will be installed for additional protection. An instantaneous broken rope type safety system will be provided. If holding cable becomes slack or breaks, the car will be immediately suspended in place by the safety rope and activation of the brake shoes. The car will stop in 6 inches when loaded at 125 percent of rated capacity.

E. Hoistway gates and car gates will constitute elevator closures. Gates will be interlocked to prevent them from being opened when car is not at landing and to prevent elevator from operating unless landing gate and car gate are closed. A cam will operate the interlocks. The rollers which support the gates will operate freely in tracks at the top.

F. An elevator call station will be provided at each landing. The station will consist of a push button mounted in a flush plate on the outside of each hatchway entrance. Each push button will have an IN USE jewel and lamp which will light when the elevator is in operation. A panel inside the car will include buttons to stop the car at each floor, an emergency stop button and a light switch.

G. Two extra heavy spring buffers mounted on suitable framing in the elevator pit will constitute a safety bumper for the elevator.

II. (Continued)

H. Idler sheaves will be securely mounted under the car in proper alignment with winding drum bearings. The sheaves will be constructed of hard cast iron or semi-steel with a diameter as large as conditions will permit. The sheaves will be accurately machined and properly grooved to accommodate cable. The sheaves will be provided with grease cups or pressure fittings to allow easy lubrication. The winding drum will be made of steel or semi-steel and will have a diameter at least 40 times that of cable. The drum will be mounted between and on two anti-friction bearings. The inner ends of bearings will be provided with wipers and the shaft will be flanged to prevent oil leakage. Automatic self-lubrication and a means of draining and flushing will be provided for the bearings. Cables will be of sufficient size and quantity to support the elevator when loaded to capacity, including a standard elevator safety factor.

J. An incandescent, vapor-tight, 150-watt light fixture with globe and guards will be mounted in the car ceiling to illuminate the car. A wall switch mounted in the car will control the light.

K. Required power will be 480 volts, 3 phase, 60-cycles.

NOTE

This Figure "A" is similar to Figure "A" 1242.3 except for increased capacity of lift.

SHEET 5 OF 5 NOMENCLATURE SERVICE LIFT, LCF FIGURE A NUMBER 1242

TYPE OF LIST
A REAL PROPERTY INSTALLED EQUIPMENT

MODEL DESIGNATION
B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION
C ENVIRONMENT

CONTRACTOR
D THE BOEING COMPANY

FIGURE A NUMBER
E 1317

MILITARY NOMENCLATURE AND FED. MFR'S CODE
F

COMMON NOMENCLATURE
G TANK SET, LIQUID STORAGE, METAL (G&C COOLING)

H ORIGINATION DATE 2-14-63
J AFBSD APP DATE 4-11-63

CONTRACT NO.
KAF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	B FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROB. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	2.58.4

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A means must be provided to store and supply enough chilled water to the G&C compartment cooling unit (Figure "A" 1214) so that the G&C compartment can be maintained at specified temperature for the emergency period during the loss of a-c power. Materials must be selected so that corrosion products in the coolant are held to a minimum and the G&C compartment heat exchanger is protected from corrosion.

B. Design Constraints

1. Power

Not applicable.

2. Physical

See D2-30081, Facilities Criteria, for WS-133B Launch Facility, Operational.

3. Interface

a. Cooler, Liquid, Guidance Section, MXK-118/F37U (Figure "A" 1214).
b. Plumbing Set, Guidance and Control, Ground Cooling (Figure "A" 1318).

(Continued)

I. B. (Continued)

4. <u>Environmental</u>

a. <u>Ambient</u>

Controlled environment is from 60 deg F at 60-percent relative humidity to 80 deg F at 45-percent relative humidity.

b. <u>Dynamic</u>

For dynamic environment see D2-30081.

5. <u>Weapons Effects</u>

See D2-30081, Facilities Criteria, for WS-133B Launch Facility, Operational.

6. <u>Monitoring</u>

Not applicable.

7. <u>Operating Life</u>

The set is designed for a life of 10 years.

8. <u>Safety Considerations</u>

Not applicable.

9. <u>Special Considerations</u>

Chilled distilled water is to be stored in the tanks.

C. <u>Operability and Maintainability</u>

Not applicable.

(Continued)

I. (Continued)

D. <u>Reliability</u>

E. <u>Applicable Documents</u>

D2-30081, Facilities Criteria for WS-133B Launch Facility Operational.

II. RECOMMENDED SOLUTION

It is recommended that two stainless steel tanks of sufficient capacity each be provided in the Launcher equipment room.

NOTE

This Figure "A" is identical to Figure "A" 1317.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C POWER	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO.
E 1323	F	G ELECTRICAL SYSTEM, LCF (HARD)	2-14-63 / 5-8-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	5-8-63						1											RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A requirement exists for a supply of alternating current power to be furnished the hardened facilities of the Launch Control Facility (LCF) to maintain Launch capabilities, Strategic Alert communications and personnel life support.

A. Functional Requirements

1. Commercial power shall be supplied for the LCF hardened facilities using alternating current power. Characteristics of the commercial power shall be 480 (± 5 percent) volts, 3 phase, 60 (± 1-1/2 percent) cycles, 3 wire, with not over 5 percent rms harmonics. It shall be supplied from an overhead pole line terminating outside the security fence. The commercial power feeders entering the site shall have protection against the effects of lightning and excessive overloads.

2. An engine driven generator unit shall be supplied by others as a standby power source. The unit shall be completely equipped for automatic operation.

3. Controls shall be provided to automatically transfer the loads from one power source to the other during the scheduled exercise period and as outlined below:

   a. A signal shall be sent the Cranking Panel to start the standby power unit if the commercial power voltage falls below 90 percent of nominal value for an adjustable period of 0 - 1 minute or when the frequency is not within 55 - 65 cycles per second.

(Continued)

Remarks: 2.52.90, 2.52.91, 2.52.92, 2.52.93, 2.52.94, 2.52.96, 2.52.98, 2.52.101, 2.52.102, 2.52.103, 2.52.104, 2.52.105, 2.52.106, 2.52.107, 2.52.108, 2.52.109, 2.52.110, 2.52.111, 2.52.114, 2.52.115, 2.52.116, 2.52.117, 2.52.118, 2.52.119, 2.52.122, 2.52.123

I.A.3 (Continued)

b. The essential loads shall be transferred to the standby generator when the generator voltage has reached a value of 90 percent nominal and frequency reaches 61 (± 1) cycles per second. Application of loads to the generator shall be sequenced to prevent excessive overloading.

c. If the commercial power returns to acceptable values before transfer of load, the load shall remain connected to the commercial power source and the standby engine generator returned to a standby status.

d. Provision shall be made to retransfer to commercial power from standby power upon restoration of commercial power to acceptable values and after an adjustable time delay, with subsequent automatic engine shutdown.

e. Provision shall be made to automatically stop the engine when either blast valve closes and restart when both valves are open. Engine starting batteries shall have sufficient capacity for specified valve openings and engine starts as specified in D2-30082.

4. A distribution system, with circuit and ground fault protection, shall be installed in the hardened facilities. An adequate amount of power shall be transformed from 480 volts to 120/208 volts, 3 phase, 60 cycle to supply the LCC and single phase loads in LCEB. The system shall be devoid of radio interference generating capability as defined in D2-30082. Maximum voltage drop from power transformers to loads shall not exceed 5 percent. A minimum distance of 24 inches shall be maintained between power and communication or signal circuits where possible. Distribution shall be as follows:

a. Power shall be distributed, with individual circuit protection loads in the LCEB, as follows:

(1) 480-volt, single-phase, 60-cycle power for engine heating to facilitate quick starting of the diesel-generator unit.
(2) 480-volt, 3-phase, 60-cycle power for Sewage Disposal System (Figure "A" 1210).
(3) 480-volt, 3 phase, 60-cycle power for instrument air compression (Figure "A").
(4) 480-volt, 3-phase, 60-cycle power for brine chilling package unit (Figure "A").
(5) 480-volt, 3 phase, 60-cycle power for cable drier air compressor (Figure "A").
(6) 480-volt, 3-phase, 60-cycle power for the hydraulic system for blast valves
(7) 480-volt, 3-phase, 60-cycle power for the air intake blower (Figure "A").
(8) 480-volt, 3-phase, 60-cycle power for the air exhaust blower (Figure "A").
(9) A minimum of 10-percent spare circuits for future loads in LCEB.
(10) 120-volt, single-phase, 60-cycle power for illumination in the LCEB.
(11) 480-volt, single-phase, 60-cycle power for the LCEB Fire Alarm System (Figure "A" 1328).
(12) 120-volt, single-phase, 60-cycle power for maintenance receptacles.
(13) 120-volt, single-phase, 60-cycle power for MCN telephone equipment.

(Continued)

I. A. 4 (Continued)

(14) 120-volt, single-phase, 60-cycle power for the Monitoring System (Figure "A" 1396).
(15) 120-volt, single-phase, 60-cycle power for fuel transfer (Figure "A" 1438).
(16) 120-volt, single-phase, 60-cycle power to supply make-up air to LCC (Figure "A").
(17) 120-volt, single-phase, 60-cycle power for engine starter battery charger.

b. Power shall be supplied and distributed with individual circuit protection in the LCC. Power circuits leaving the LCC shielded housekeeping room shall be filtered to surpress electrical interference to the limits defined in D2-30082.

Power shall be distributed as follows:

(1) 120-volt, single-phase, 60-cycle power for illumination in the Capsule.
(2) 120-volt, single-phase, 60-cycle power for maintenance receptacles.
(3) 120-volt, single-phase, 60-cycle power for carbon canister, air purifier unit in the Ambient Atmospheric Environment Control System (Figure "A").
(4) 120-volt, single-phase, 60-cycle power for heating water (Figure "A" 1324).
(5) 120-volt, single-phase, 60-cycle power for food storage and preparation (Figure "A" 1336).
(6) 208-volt, 3-phase, 60-cycle power for duct heaters (Figure "A").
(7) 208-volt, 3-phase, 60-cycle power to operate the 60/400-cycle motor generator set (Figure "A" 14106).
(8) 208-volt, 3-phase, 60-cycle power to operate the emergency battery chargers (Figure "A" 14101).
(9) A minimum of 10-percent spare circuits for future loads.
(10) 120/208-volt, 3-phase, 60-cycle, 4-wire circuit to LCC Supervisory Panel for voltage monitoring (Figure "A" 1396).
(11) 208-volt, 3-phase, 60-cycle power for the air handling unit of the Ambient Atmospheric Environment Control System (Figure "A").

5. A grounding network shall be provided for the hardened facilities of the LCF.

a. The following grounding subsystems shall be included in this network:

(1) Electronic equipment.
(2) Structures and equipment.
(3) Lightning.
(4) Electric power.

(Continued)

I. A. 5 (Continued)

b. The water well casing for the site shall be used as the primary grounding means, unless its resistance to ground is greater than 5 ohms, in which case a grounding counterpoise, consisting of interconnected ground rods, shall be added. An LCF grounding tie point (LCFGP) shall be provided at the water well casing.
c. A grounding tie point shall be provided in the LCC (Capsule) to be called the LCCGP. All grounding subsystems shall be connected to this point and it shall be connected to the primary grounding means (LCFGP) by two insulated No. 4/0 copper conductors or the equivalent thereof.
d. An instrument ground tie point shall be provided in the LCEB to which telephone equipment in the LCEB shall be connected. The instrument ground tie point shall connect to the LCCGP.
e. The primary power neutral shall be grounded and shall be carried insulated throughout the hardened facilities.
f. The power neutral, prior to connection to ground and equipment, shall have a minimum resistance of 1 megohm to ground.
g. The electronic equipment grounding subsystem shall be insulated and separated from all other subsystems by a minimum of 24 inches.
h. The LCCGP, LCFGP and connecting conductors shall withstand the weapons effects specified in D2-30082.

B. Design Constraints

1. Power

Not applicable

2. Physical

Not applicable

3. Interface

a. Commercial power company shall make power available at the take-off pole at 480 volts, 3 phase, 60 cycles, 3 wire.
b. Electrical System, LCSB, Figure "A" 1437.
c. Fuel System, LCEB, Figure "A" 1438.
d. Environmental Control System (Figure "A").

(Continued)

I. B. (Continued)

4. Environmental

a. Ambient

The Electrical System shall resist all degrading effects of ambient conditions as specified in D2-30082.

b. Dynamic

The Electrical System shall withstand weapon effects as specified in D2-30082.

5. Weapons Effect

a. Power load centers (switchgear) in the LCC and LCEB shall be shock mounted.
b. Circuits between hardened structure and shock mounted equipment shall be extra flexible wire in flexible conduit and looped to accommodate shock displacement.
c. Lighting fixtures attached to the hardened structure shall be shock mounted.
d. See BSD Exhibit 62-83 Weapons Effects Criteria.

6. Monitoring

a. Power to the LCEB shall be monitored.

7. Operating Life

Electrical equipment shall have a life span of 10 years, with minimum maintenance.

8. Safety Considerations

All high voltage equipment shall be properly labeled.

9. Special Considerations

Not applicable

(Continued)

I. (Continued)

C. Operability and Maintainability

The Electrical System shall conform to the criteria as specified in AF/BSD Exhibit 62-53.

D. Reliability

E. Applicable Documents

D2-30082, WS-133B Launch Control Facility Facilities Criteria, Operational.
D2-6952, Volume II, S-133A11-0-3 WS-133A OGE Figure "A's".
AF/BSD Exhibit 62-77, Electric Power and Cabling Subsystem Criteria for WS-133B Minuteman Weapon Systems.
BSD 62-75 Electrical Grounding Criteria.
AF/BSD Exhibit 62-53, Maintainability.

II. RECOMMENDED SOLUTION

A. Commercial alternating current power will be supplied at 480 (± 10 percent) volts, 3 phase, 60 (± 1-1/2 percent) cycles, 3 wire, with less than 5-percent rms harmonics. Power will be furnished by a local power company to a power takeoff pole located at least 20 feet outside the security fence. The underground feeders entering the site will be equipped with lightning arresters at the pole and at the Main Distribution Panel in the LCEB in accordance with National Electrical Code. Feeders will run from the power pole to the line side of the main circuit breaker in the LCSB and then down to the LCEB. Major items of equipment are:

1. Class 3, 35-foot wood pole.
2. 3-wire lightning arresters.
3. Crossarms, with conduit clamps.
4. Conduit and hardware.
5. Underground conduit and wiring.

(Continued)

II. (Continued)

B. An engine generator unit will be supplied as part of the Environment Control System to serve as a standby power source.

C. Two electrically operated and mechanically interlocked draw-out type air circuit breakers will be provided for transferring the essential loads from commercial to standby power or vice versa and for providing circuit protection for commercial and standby main feeders. Auxiliary devices will perform the following functions:

1. Start diesel engine automatically if commercial power voltage falls below 90 percent nominal for an adjustable period of 0 - 1 minute, or when frequency is not within 60 ± 1-1/2 percent cycles per second or when single phasing of the commercial power occurs.

2. Transfer the loads necessary to maintain an alert status to the standby bus when generator voltage reaches 90 percent nominal and frequency is 61 (± 1) cycles per second.

3. Load will not transfer to standby set if commercial power returns to acceptable values before the standby power has reached transfer values. Engine will shut down automatically after a preset period.

4. Retransfer load from standby to commercial power automatically when commercial power reaches acceptable values and after an adjustable time delay, with subsequent engine shutdown.

5. A means of control of power transfer will be provided in the LCC.

6. Time delay relays and contactors as needed will be provided to sequence the loading of the standby generator.

D. A power distribution system will be installed in the hardened facilities to distribute power and provide individual circuit protection. The Main Distribution Panels will provide power and protection to sub-panels and junction boxes which will service all equipment in the hardened facilities as itemized in Step A-4 of Technical Requirements. A grounding transformer will be provided to give ground fault protection to the 480 volt system, and will be connected ahead of the main circuit breaker.

A minimum separation of 24 inches will be maintained between power lines and signal or communications circuits when possible.

(Continued)

II. D. (Continued)

The system will be devoid of radio interference generating capability as defined in D2-30082. A 480 to 208Y/120 volt transformer will be provided for loads requiring 120 and/or 208 volts.

Maximum voltage drop from transformers to loads will not exceed 5 percent. Power circuits entering the LCC will be protected as follows:

1. Voltage surges caused by nuclear detonations or lightning will be passed to ground by lightning arresters connected to the incoming power lines and the structures and equipment ground bus.

2. Electromagnetic pulse protection will be provided for the LCC by a steel liner completely enclosing the interior of the Capsule.

3. RFI protection will be provided for by physically separating housekeeping equipment from electronic equipment and enclosing housekeeping equipment in a shielded room.

4. Major items of equipment include:

   a. Shielded room and steel liner.
   b. Interference suppression filters.
   c. Lightning arresters.
   d. Grounding conductors.

E. A grounding network will be provided at the LCC to serve the hard facilities. It will have a maximum resistance to ground of 5 ohms.

1. The following grounding subsystems will be included in this network:

   a. Electronic equipment (to be installed by others).
   b. Structures and equipment: all steel structures, equipment cases, platforms and nonelectrical equipment will be grounded.
   c. Lightning: the neutral of the surge arresters in the LCEB will be connected to the LCEB structures and equipment ground.
   d. Electric power: the neutral of the grounding transformer will be connected to the LCEB structures and equipment ground. The neutral of the 120/208 volt system will be grounded to the LCEB structures and equipment ground by a single connection at the 480-208Y/120 volt transformer.

2. The water well casing will be used as the primary earth ground.

(Continued)

II. E. (Continued)

3. A grounding tie point for all subsystems will be located in the LCC (Capsule). All grounding subsystems in hardened facilities will connect to this LCCGP, and it will be connected to the water well casing by two No. 4/0 copper conductors in conduit.

4. Instrument ground tie points will be located in the LCEB and connected to the LCCGP by a insulated copper conductor.

5. Prior to connection to the ground and equipment, the power neutral will have a minimum resistance to ground of 1 megohm.

6. Instrument, equipment and power neutral grounds from the LCSB will also be grounded to the LCCGP through the structures and equipment grounding subsystem.

7. The LCCGP, LCFGP and interconnecting conductors will withstand the weapons effects specified in D2-30082.

8. Power secondary feeders will be protected at the power takeoff pole by lightning arresters grounded to a ground rod at base of pole and also to conduit carrying feeders to site, where conduit will be connected to structures and equipment ground bus.

NOTE

This document is similar to Figure "A" 1323.3 except for the addition of 480 volt distribution, increased loads, shielded room, relocation of equipment, and deletion of the diesel generator set (Figure "A").

The automatic switch unit is replaced by two interlocked electrically operated circuit breakers.

TYPE OF LIST
A REAL PROPERTY INSTALLED EQUIPMENT

MODEL DESIGNATION B SM-80 WEAPON SYSTEM
SUB SYSTEM IDENTIFICATION C LIFE SUPPORT
CONTRACTOR D THE BOEING COMPANY

FIGURE A NUMBER E 1324
MILITARY NOMENCLATURE AND FED. MFR'S CODE F
COMMON NOMENCLATURE G WATER SUPPLY SYSTEM, LCF
H ORIGINATION DATE 2-14-63
J AFBSD APP DATE 5-8-63
CONTRACT NO. K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-3	6A	STL Review	5-8-63						1											RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide an automatically controlled water supply at the LCF for personnel support, fire protection capability, and equipment demands. The Water Supply System shall satisfy the following requirements:

1. Raw water supply equipment shall transfer water from the water source to storage in the LCSB, automatically upon demand. A low point at the water source shall deactivate the supply equipment. Raw water shall be available for manually maintaining a minimum water level in the sewage lagoon.

2. All water supplied to storage shall be chlorinated. Chlorine residual at point of consumption shall be within commonly accepted limits. Additional treatment shall be as required to produce an effluent of acceptable quality. The type of water treatment required shall be established by a reported analysis of the raw water at each site. The quantity of water through portions of the treatment system shall be metered and indicated. A preset quantity shall be sensed and a signal transmitted to alert personnel at LCSB for required replenishing and reactivating of designated treatment equipment (Figure "A" 1396).

3. Water is required for fire protection at the LCSB. Water storage and transfer equipment shall supply water to two hose units at 70 gpm for a minimum period of 30 minutes. Transfer equipment shall be automatically controlled upon demand. Storage tank levels shall be sensed and signals transmitted to water supply equipment controls and to transfer equipment controls. The water storage level shall be indicated in LCSB Water Treatment Room.

(Continued)

Remarks:
2.54.37
2.54.37.1
2.54.37.2
2.54.37.3
2.54.37.4
2.54.37.5
2.54.37.6
2.54.37.7
2.54.37.8
2.54.37.9
2.54.37.10
2.54.37.11
2.54.37.12
2.54.37.13
2.54.37.14
2.54.37.15
2.54.37.16
2.54.37.17
2.54.37.18
2.54.37.19
2.54.37.20
2.54.37.21
2.54.37.22
2.54.37.23
2.54.37.24
2.54.37.25
2.54.37.26

I. A. (Continued)

4. Treated water for domestic use shall be stored and pressurized in a hydropneumatic tank, sized to meet the maximum combined domestic demand of the LCF facilities at a useable pressure. Pressure in the hydropneumatic tank shall be maintained by air delivered at a controlled pressure.

   Water levels in the tank shall be sensed and signals transmitted to the water supply equipment. Water storage level shall be indicated in the LCSB Water Treatment Room.

5. Portable water shall be delivered to the LCSB to meet the domestic requirements of the resident population at 100 gpd for each resident. A nominal quantity of make-up water at 15 psig minimum shall be delivered to the LCSB Heating System. Hot water shall be provided in the LCSB for domestic use.

6. Potable water shall be delivered to the LCC to meet the domestic requirements of three persons. Protection is required to prevent transmission of shock waves through water supply line to the LCC interior. A closure device shall be provided to prevent flow into LCC through water line. This closure device shall operate automatically upon initial blast effect.

7. A supply of hot water shall be provided in the LCC for domestic use.

8. A requirement exists to provide an emergency supply of potable water for use by the LCC occupants during the emergency standby period. The minimum quantity supplied shall be 2500 gallons of which 300 gallons shall be drinking water. This supply shall be pressurized during the period of use. Provision shall be made to insure that the drinking water will remain potable during the periods of use. Means shall be provided to indicate the quantity of water in storage.

9. A requirement exists to provide hardened underground storage for a minimum supply of 150,000 gallons of mineral-free water for the Environmental Control System, LCF . Replenishment capability must be provided to meet the demand of scheduled exercise periods and possible commercial power failures during the preattack period. Provision shall be made to prevent contamination of the water supply during the storage period. Means shall be provided to ascertain stored water quantity and to indicate quality of effluent.

B. <u>Design Constraints</u>

1. <u>Power</u>

   All equipment shall operate on commercial or standby power distribution.

2. <u>Physical</u>

   Equipment, except supply, shall be housed in the water treatment room at the LCSB.

(Continued)

I. B. (Continued)

3. Interface

Supply equipment shall suit existing water wells. Existing wells will supply 5 gpm minimum. Sewage Disposal System, LCF (Figure "A" 1210, Heating System, LCSB (Figure "A" 1325), Environmental Control System, LCF (Figure "A").

4. Environmental

a. Ambient

(1) Supply equipment at water well must operate between 30 deg F and 120 deg F.

b. Dynamic

Not applicable

5. Weapon Effects

The potable water supply in the LCC and the water supply required by the Environmental Control System (Figure "A") must survive weapon effects as specified in Exhibit 62-83, Weapons Effects Criteria.

6. Monitoring

The water treatment equipment shall be electrically monitored to alert LCSB personnel that certain items are in need of replenishment to insure desirable water quality.

7. Operating Life

8. Safety Considerations

Not applicable

9. Special Considerations

Not applicable

(Continued)

I. (Continued)

C. Operability and Maintainability

Personnel at LCF required to check and periodically add chemicals to water treatment equipment.

D. Reliability

E. Applicable Documents

D2-30082, Facilities Criteria for WS-133B, Launch Control Facility Operation.

II. RECOMMENDED SOLUTION

A. A submersible well pump will be provided at all sites and will be automatically controlled from the LCSB. An air bubbler tube will be installed in the well and a pressure switch will be provided to cut off the pump at a predetermined low level in the well. Pump discharge line will be routed to the water treatment room in the LCSB. Pipe will be underground with sufficient cover to prevent freezing. A three way solenoid operated valve will be installed to deliver raw water to a floor sink in the treatment room and to shut off delivery of water to normal storage. When it is necessary to raise the water level in the sewage lagoon, the solenoid valve will be operated from the control panel by a manual switch. It will simultaneously start the well pump. Electrical interlock will be provided to insure that all treatment equipment is deenergized during raw water delivery to sewage lagoon. Well casing vents, sand traps, and sediment strainers will be installed as required by site conditions.

B. A water treatment system will be provided to produce potable water. Raw water analysis from each site will establish the type of treatment provided. A pressure control valve and a flow controller will deliver raw water to the treatment system at a rate of 5 gpm and at constant pressure. At all sites, water delivered to storage will be chlorinated by means of a hypochlorinator unit.

(Continued)

II. (Continued)

C. A coated, cylindrical steel tank will be installed underground to provide bulk storage of potable water. The tank will be equipped with a covered manway extending to the surface, a vent pipe extending above the surface and nozzles for pipe connections and transfer pumps. A bubbler tube will be provided connected to a liquid level gage in the LCSB. It will have pressure switches for controlling the well pump and the bulk tank transfer pumps.

D. A vertical turbine pump will be flange mounted on the bulk storage tank. It will transfer water to the hydropneumatic storage tank. The pump will start at low air pressure in the tank and stop at high level sensed through the liquid level indicator. A pressure switch will stop the pump on a low level in the bulk storage tank.

A standby vertical turbine pump will be flange mounted on the bulk storage tank. It will transfer water to the distribution system with a bypass to the hydropneumatic tank. This pump will provide the water required for emergency demands. It will start at c below normal pressure in the hydropneumatic tank and stop on the same conditions as outlined for the previous pump.

The transfer system will supply water to two hose units at 70 gpm total flow for 60 minutes. Pressure will be sufficient to provide at least 25 pounds per square inch at one outlet with water flowing, and 12 pounds per square inch at the furthest outlet with 70 gpm flowing.

E. A coated, cylindrical steel storage tank will be installed in the LCSB to provide hydropneumatic storage of potable water. A compressed air system, consisting of compressor, receiver, valves, piping, indicator and control switch will be piped to the hydropneumatic tank to maintain air pressure in the tank. It will also provide air for the bubbler tubes and water treatment equipment. A sight gage will provide water level indication for the hydropneumatic tank. A pressure gage will be installed in the discharge line.

F. Piping will be provided to convey potable water from the hydropneumatic bulk storage tank to the LCSB water system, where it will be distributed to the toilet fixtures, kitchen facilities, water dispenser, hot water boiler, laundry equipment and fire fighting hose units. A 100-gallon, 15000-watt electric water heater will be installed in the utility room to provide hot water at 140 deg F minimum.

G. Piping will be provided from the hydropneumatic tank to the LCC where a shock actuated automatically operated shutoff valve will be provided. A shock attenuator will be mounted in the pipe at the inside wall of the LCC.

(Continued)

II. (Continued)

H. A coated steel tank will be installed in the LCC to store sufficient water to meet the needs of the occupants during the post-attack and post-launch periods. During the pre-attack period, all water consumed in the LCC will be drawn through the water storage tank.

During the post-attack and post-launch periods, the water storage tank will be pressurized by compressed air cylinders. The compressed air supply will be controlled by a manually operated remote control from the LCC Supervisory Panel. A level indicating device will be installed in the tank.

J. An electric water heater will be installed in the LCC. It will provide hot water at 140 deg F.

K. A battery of four horizontal cylindrical steel tanks with a combined capacity of 155,000 gallons will be installed under ground near the LCEB. They will be interconnected, top and bottom in series, to equalize liquid levels. Tanks and connecting piping will be designed to resist corrosive effects of demineralized water and soil conditions.

M. A common fill and suction line will be employed, connecting the nearest tank to the LCEB. A tee connection will be provided in the LCEB for the pump suction line. The fill pipe will be routed from the LCEB to the above Grade fill point. At point of penetration in the LCEB, a normally closed, manually operated plug valve will prevent transmission of blast overpressure except during filling operation.

A single vent line will connect the farthest tank to the LCEB.

N. A manually actuated liquid level indicator with a bubbler tube will be provided to determine level in the storage tank. A conductivity instrument will be installed in the LCEB to indicate water quality. The conductivity cell will be located on the common fill and suction line so that the quality of both incoming and outgoing water may be determined.

P. The system will contain the following equipment:

1. Well pump with magnetic starter, (480 volts, 3 phase, 60 cycles).
2. Well head pit with cover.
3. Sand trap.
4. Pressure control valve.
5. Flow rate controller.
6. Three-way solenoid operated valve.

(Continued)

II. (Continued)

7. Chlorination unit.
8. Water treatment equipment as required.
9. Water storage tank.
10. Transfer pump with magnetic starter (480 volts, 3 phase, 60 cycles).
11. Standby transfer pump with magnetic starter (480 volts, 3 phase, 60 cycles).
12. Check valves, three each.
13. Hydropneumatic tank.
14. Sight gage.
15. Level controller, two each.
16. Level indicator, remote reading.
17. Pressure switch.
18. Air solenoid valve, two each.
19. Electric water heater, LCSB.
20. Shock attenuator for water line.
21. Water line valve with pneumatic closure device.
22. Emergency water storage tank, LCC.
23. Level indicator, remote reading.
24. Source of regulated compressed air.
25. Three-way solenoid operated valve.
26. Toggle switch on LCC Alarm Panel.

(Continued)

II. (Continued)

27. Electric water heater, LCC.

28. Flexible hoses, four each.

29. Piping and associated fittings.

30. Demineralized water storage tanks.

31. Conductivity instrument.

NOTE

This Figure "A" is similar to Figure "A" 1324.3, except for changes to meet the new WS-133B Weapons Effects Criteria, differing site conditions, and AF/BSD Exhibit 62-80 requirements (ECS).

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO.
E 1325	F	G HEATING SYSTEM, LCSB	2-14-63 / 5-8-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	5-8-63						1											RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A requirement exists to heat the LCSB to maintain efficient equipment operation and provide personnel comfort. 2.53

A. Functional Requirements 2.53.3

1. A hot water heating system shall be provided to supply sufficient hot water to heat equipment and personnel areas of the LCSB. It must be controlled automatically to maintain adequate water temperature to satisfy heating requirements. The system must be capable of automatically modulating temperature of circulating water to compensate for outside temperature changes. There shall be a provision for the expansion of heated water.

2. A circulation system is required to distribute hot water to equipment and personnel areas of the LCSB. A provision must be included to chemically inhibit corrosion in the system by removing excess free oxygen from the water.

3. The system shall be capable of maintaining minimum temperature requirements in equipment areas. Heat shall be transferred from water to air and circulated throughout the water treatment room with forced air heating equipment. The water treatment room heating equipment shall be automatically controlled to maintain a minimum room temperature of 45 deg F. Heat shall be transferred from water to air and circulated throughout the telephone equipment room with forced air heating equipment. The heating equipment shall be automatically controlled to maintain a minimum room temperature of 65 deg F.

Remarks: 2.53.3.1, 2.53.3.2, 2.53.3.3, 2.53.3.4, 2.53.3.5, 2.53.3.6, 2.53.3.7, 2.53.3.8, 2.53.3.9, 2.53.3.10, 2.53.3.11, 2.53.3.12, 2.53.3.13, 2.53.3.14

(Continued)

I. A (Continued)

4. The system shall transfer required heat from water to air to maintain personnel living, office and recreation areas at a minimum temperature of 70 deg F. Heat shall be transferred from water to air and circulated throughout the kitchen with forced air heating equipment. Kitchen heating shall be automatically controlled to maintain a minimum room temperature of 70 deg F.

5. Sufficient heat shall be supplied the Environmental System equipment room when the Environmental Systems equipment is not operating. It shall be controlled for automatic operation when the inside air temperature drops to 40 deg F.

6. Sufficient heat shall be supplied the generator room when the diesel generator set is not operating. It shall be controlled for automatic operation when the inside air temperature drops to 40 deg F.

7. Sufficient heat shall be supplied the garage. It shall be controlled for automatic operation when the inside air temperature drops to 40 deg F.

B. Design Constraints

1. Power

120-volt, single-phase and 208- or 460-volt, 3-phase, 60-cycle power is available.

2. Physical

Not applicable

3. Interface

a. Water Supply System, LCF, Figure "A" 1324.
b. Electrical System, LCSB, Figure "A" 1437.
c. Fuel System, LCSB, Figure "A" 1230.
d. Environment Control, LCC, Figure "A"

4. Environment

For natural environment see D2-30082.

5. Weapons Effect

Not applicable.

(Continued)

I. B. (Continued)

6. **Monitoring**

Not applicable

7. **Special Considerations**

Not applicable

C. **Operability and Maintainability**

1. The hot water heating system shall fit the space requirements of the utility room allowing adequate room for cleaning and maintenance.

2. The burner unit shall be readily accessible for inspection, cleaning, and maintenance.

D. Reliability

E. **Applicable Documents**

D2-30082, Facilities Criteria for WS-133B, LCF.

II. RECOMMENDED SOLUTION

It is recommended that a circulating hot water heating system and electric unit heaters be provided to heat equipment and personnel areas of the LCSB. The system will consist of the following:

A. An oil-fired package boiler with associated piping and control valves. The boiler will be thermostatically controlled to maintain boiler water temperature at 200 deg F. A package controller, including outside air element and reset thermostat, and a modulating mixing valve will be provided to vary system output in accordance with outside temperature. A centrifugal circulating pump will be provided. An expansion tank will be provided to allow for the expansion of heater water.

B. A two-pipe, circulating water system will be provided to supply heated water to personnel and equipment areas and return water to the boiler. A pot feeder will be provided for addition of chemicals to inhibit corrosion in the boiler and water pipes and will be manually controlled.

(Continued)

II. (Continued)

C. A hot water unit heater will be provided for heating the water treatment room. A thermostat will automatically energize the heater when room temperature falls below 45 deg F. A hot water unit heater will be provided for heating the telephone equipment room. A thermostat will automatically energize the heater when room temperature falls below 65 deg F. A hot water unit heater will be provided for heating the kitchen. A thermostat will automatically energize heater when kitchen temperature falls below 70 deg F.

D. A network of finned-tube convectors will be provided to maintain personnel living, office and recreation areas at a minimum temperature of 70 deg F. Sizes of convectors will vary with sizes of rooms to be heated. Convectors will have sloping top cabinets with manual dampers. They will have valves and connections to hot water supply and return lines. A hot water unit heater will be provided for heating the kitchen. A thermostat will automatically energize heater when kitchen temperature falls below 70 deg F.

E. An electric unit heater will be provided for heating the Environmental System equipment room. A thermostat will automatically energize the heater when room temperature falls below 40 deg F and will be interlocked with the brine-to-air heat exchanger fan (Figure "A") so that the heater can be in operation only when the fan is not operating.

F. An electric unit heater will be provided for heating the generator room. A thermostat will automatically energize the heater when room temperature falls below 40 deg F and will be on a nonessential circuit so that the heater can be in operation only when the diesel engine is not operating.

G. An electric unit heater will be provided for heating the garage. A thermostat will automatically energize the heater when room temperature falls below 40 deg F.

H. The system will contain the following equipment:

1. Package controller for boiler, including two outside air elements, heating thermostat, reset thermostat, immersion element and modulating mixing valve, 120 volts, single phase, 60 cycles.
2. Water pump, 480 volts, 3 phase, 60 cycles.
3. Expansion tank.
4. Hydrazine pot feeder.
5. Hot water unit heaters, 120 volts, single phase, 60 cycles.

(Continued)

II. H. (Continued)

6. Thermostat controls with relays.

7. Hot water convectors with piping and valves.

8. Electric unit heaters, 480 volts, 3 phase, 60 cycles; electric thermostats and relays.

9. Packaged oil-fired boiler, 120 volts, single phase, 60 cycles.

NOTE

This Figure "A" is similar to Figure "A" 1325.3 except for changes to meet site conditions and heating requirements for the Environmental System equipment room, the generator room and the garage.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO.
E 1326	F	G BLAST DOOR INSTALLATION, LCC	2-14-63 / 4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE (1)	CODE (2)	INITIATED BY (3)	AFBSD APPROVAL DATE (4)	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS (1)	FEDERAL ITEM ID NUMBER (2)	MANUFACTURER'S PART NUMBER (3)	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP (1)	LCF (2)	MLCC (3)	SMSB (4)	SRA (5)	MAMS (6)	VAFB (7)	(8)	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						3						CFE			W-6	2.53.2.9

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A blast resistant closure is required at the LCC entry for protection of weapon system equipment and personnel located in the LCC from all normal and induced environmental effects and to permit free passage for equipment and personnel.

B. Design Constraints

1. Power

Not applicable.

2. Physical

a. The blast door will swing out from the blast door frame to provide a maximum clear opening of 36 inches by 62 inches.
b. The blast door steel frame will have an electrical continuity with the inner steel liner of the LCC.
c. The blast door will have a blast-resistant latching mechanism with provision for manual control from inside the LCC.

3. Interface

a. The blast door installation will interface with the LCC hardened structure.
b. The blast door installation will interface with the LCCGP (Launch Control Center Ground Point).

(Continued)

I. B. (Continued)

4. Environment

a. Ambient

(1) The blast door installation will have an environmental seal to prevent deterioration of the LCC environment from exterior water seepage and dust.
(2) The blast door installation will resist all degrading effects of climatic conditions.

See D2-30082.

b. Dynamic

(1) The blast door installation will be capable of resisting ground shock in all planes and blast pressures on exposed surfaces, individually or simultaneously, including follow-up vacuum effects per D2-30082.
(2) The blast door installation will provide a shield capable of attenuating nuclear, thermal and electro-magnetic radiations and acoustical peaks to the acceptable parameters for the LCC environment.
(3) The blast door installation will provide a seal to prevent blast pressure leakage into LCC.

See D2-30082.

5. Weapons Effects

a. Ground Shock and Blast Pressures

See Response Spectra D2-30082.

b. Chemical, Biological, Radiation

The blast door will have a seal to prevent entry of exterior chemical, biological and radiation contaminants and blast pressure leakage.

6. Monitoring

Not applicable.

7. Operating Life

D2-30082.

I. B. (Continued)

8. Safety Considerations

Not applicable.

9. Special Considerations

a. For finishes, see D2-30082,
b. Blast door will open and close upon a manual application of a 25-pound initial force and a 10-pound sustaining force.

C. Operability and Maintainability

Maintenance/emergency provision for actuation or repair of blast door locking mechanism will be provided on the outside of the LCC.

See D2-30082,

D. Reliability

E. Applicable Documents

D2-30082 Facilities Criteria for WS-133B Launch Control Facility Operational.

II. RECOMMENDED SOLUTION

The LCC entry will consist of a recessed door frame with a hinged door to close against environmental seals. A locking mechanism, manually controlled from the interior of the LCC shall secure the door. The blast door installation will effectively resist all normal and induced environmental effects,

A. The following particulars define the blast door installation:

1. The opening into the LCC will be 36 inches by 62 inches.
2. The blast door frame will be of welded steel plate anchored integral with the LCC concrete structure and independent of tunnel floor level.

II. A. (Continued)

3. The blast door will be a closed steel frame with a concrete grout core, and will be hinged vertically to swing horizontally outward from the LCC to provide full open access when the door is rotated through an angle of 100 degrees.
4. The hinges will be fabricated of steel and secured to the door frame. The vertical load of the door will be supported by thrust bearings. The hinge pins will rotate in bearings. The hinge design will permit opening and closing of door upon application of a manual force.
5. Exterior contamination and blast pressure leakage will be excluded by a seal bonded to the door and compressed against the door frame bearing plates.
6. The blast door will be locked by means of hardened steel pins, chamfered for easy entry into mating receptacles in the door. The lock pins will be capable of adjustable alignment.
7. The lock pins will be actuated by a hydraulic unit mounted on the outer door frame and provided with a security cover plate. Actuation will be by manual control from inside the LCC.
8. The blast door will be provided with a continuous copper grounding contactor bearing on door frame in closed position. The frame will have electrical continuity with the inner steel liner of the LCC for attenuation of electromagnetic radiation.
9. The blast door installation will be provided with copper grounding straps.

B. The blast door installation consists of the following equipment:

1. Blast door frame, welded steel structure, wall brackets and anchors.
2. Blast door, welded steel structure, concrete grout core, lock pin receptacles.
3. Environmental seal.
4. Electromagnetic seal.
5. Blast door hinges, mounting attachments, hinge pins, thrust bearings.
6. Hydraulic actuating unit, piping and controls, security cover plate.
7. Copper grounding straps.

NOTE

This Figure "A" is identical to Figure "A" 1326,3 Revision Basic.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C SECURITY.	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO.
E 1327	F	G SECURITY SYSTEM, LCF	2-14-63 / 4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63						1					3						RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

1. Provide a security compound enclosed by a security-type fence with a single manually operated access gate visible from the security room. The gate shall have a remotely controlled latch, operated from the security room with provision for emergency manual override on each side of gate. Monitoring display of the status of the gate shall be provided in the security room (Figure "A" 1396).

2. Provide surveillance lighting to illuminate the security compound and access gate to provide night identification of entering personnel, by the security guard. Lighting control shall be provided in security room.

3. A closure shall be provided for equipment access to the access shaft vestibule. It shall be capable of being secured on the inside only, to protect against unauthorized entry.

4. A personnel access closure shall be provided for the entry from the security office to the access shaft vestibule. It shall be equipped with a remote controlled latch. Capability for local manual override shall be provided on each side of door for emergency use only.

   Door latch operating capability shall be provided in the LCC only (Figure "A" 1396).

Remarks: 2.55.1, 2.55.2, 2.55.3, 2.55.4, 2.55.5, 2.55.6, 2.55.7, 2.55.8, 2.55.9

(Continued)

I. (Continued)

B. Design Constraints

1. Power

Facility power is required at 120 volts, single phase, 60 cycles.

2. Physical

3. Interface

Control of the security compound access shall be on the Monitoring Panel in the LCSB Monitoring Panel.

The Security System, LCF shall interface with the Electrical System, LCF (Figure "A" 1437). Control of the access shaft personnel access shall be on the LCC Supervisory Panel (Figure "A" 1396).

4. Environmental

Equipment must operate successfully down to minus 40 deg F and up to 122 deg F.

5. Weapons Effect

6. Monitoring

Status of security compound access closure and LCEB blast door shall be monitored.

7. Special Considerations

Not applicable.

(Continued)

I. (Continued)

C. Operability and Maintainability

Continuous 24-hour surveillance and control of access facilities shall be maintained.

D. Reliability

E. Reference Documents

D2-30082 WS-133B Launch Control Facility Operational Facility Criteria. D2-6952, Volume II S-133-0-11, WS-133A OGE Figure "A's".

II. RECOMMENDED SOLUTION

It is recommended that a Security System will be provided to protect the LCF from unauthorized entry. The system will have the following provisions:

A. A security compound will be formed by enclosing the immediate LCF area including antenna farm with a security-type fence with outrigger extension arms mounted on the posts and carrying barbed wire strands. A single access opening will be provided in the fence and will be closed by a sliding gate of the same construction as the fence. The gate will be equipped with an automatic snap locking latch capable of operating at temperatures down to minus 40 deg F. The latch will be electrically operated on 120-volt, single-phase, 60-cycle power by a push button on the Monitor and Alarm Station in the security room (Figure "A" 1396). A key-actuated override will be provided on each side of the gate for manual unlatching in an emergency.

B. Illumination of the security compound and access gate will be provided by 500-watt floodlights mounted on the eaves of the LCSB and pole-mounted 500-watt floodlights located to suit on-site plot plans. The floodlights will be adjustable horizontally and vertically and be of the enclosed type with a stippled, convex, heat-resisting lens, hinged and gasketed.

(Continued)

II. B. (Continued)

All floodlights will be manually controlled from the security room in the LCSB (Figure "A" 1437).

C. The equipment access opening to the access shaft vestibule will be protected by two hollow metal doors. They will be equipped with a security-type latch set on the active door with a rigid knob inside and out, keyed on inside only and with a chain bolt and foot bolts on inactive door inside.

D. The personnel access to the access shaft vestible to LCC hardened area will be protected by a hollow metal door with a clear wire glass vision panel.

The door will be equipped with a mortise-type electric latch, operated on 12-volt, single-phase, 60-cycle power by a push button on the LCC Supervisory Panel (Figure "A" 1396). A 120/12-volt transformer and wiring will be provided and connected to the facility power (Figure "A" 1437). The latch will be provided with a key-operated override for manual emergency opening of the door from either side.

E. The system will contain the following equipment:

1. Chain link fencing, posts, gate and barbed wire.
2. Electromechanical lock with limit switch (access gate).
3. Floodlights, eave and pole attachments, poles and switches.
4. Hollow metal doors, with special hardware.
5. Electromechanical lock with transformer (personnel access door).

NOTE

This Figure "A" is identical to Figure "A" 1327.3.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C LIFE SUPPORT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE / AFBSD APP DATE	CONTRACT NO.
E 1328	F	G FIRE ALARM SYSTEM, LCF	H ORIGINATION DATE 2-14-63; J AFBSD APP DATE 4-11-63	K AF 04(694)-266

L REVISIONS: Revision Date 1	Code 2	Initiated By 3	AFBSD Approval Date 4	M Functional Class Index	N Stock Number: Fed. Supply Class 1	Federal Item ID Number 2	Manufacturer's Part Number 3	P Basis of Issue and Quota Allocations: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod. Lead Time	X End Item	Effectivity	Y Remarks
2-22-63	6A	STL Review	4-11-63						1					3						RPIE			W-6		2.37.6 2.37.20 2.37.24 2.54.14 2.54.34

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide adequate warning to personnel in the Launch Control Facility of a fire occurring in the LCEB, the LCSB or the access shaft. The warning system shall consist of manual stations and automatic fire detection devices located to adequately cover the LCSB, access shaft and LCEB. Detection of a fire in the LCSB or access shaft shall sound an alarm in the LCSB and the LCC. Detection of a fire in the LCEB shall sound an alarm in the LCEB and LCC. Detection shall be on a continuous basis.

B. Design Constraints

1. Power

System shall operate on direct current power and be provided with means to rectify normal power supply of 480-volt, single-phase, 60-cycle, a-c power. Provide an alternate power source to operate system when normal a-c supply is not available.

2. Physical

Not applicable.

3. Interface

Electrical Systems, Figure "A" 1323 and 1437, Monitoring System, Equipment Fault, Figure "A" 1396, Ambient Atmospheric Environment Control System, Figure "A" 1212,

(Continued)

I. B. (Continued)

4. **Environmental**

System components shall operate efficiently under ambient conditions as outlined in D2-30082.

5. **Weapons Effect**

Circuits between shock attenuated equipment and hardened surfaces shall be extra flexible with loops to withstand sudden movements without breaking.

6. **Monitoring**

System shall be monitored in the LCC, LCEB and LCSB by electrical signal to lights and bells.

7. **Special Considerations**

Control panel cabinet and manual stations shall be painted red.

C. **Operability and Maintainability**

The system shall be electrically supervised against faults in the wiring system. A means of testing detection loops and alarms shall be provided.

D. **Reliability**

E. **Applicable Documents**

D2-30082, WS-133B Launch Control Facility Operational Facilities Criteria. D2-6952, Volume II, S133-11-0-3, WS-133A, OGE Figure A's. Standard No. 72, National Board of Fire Underwriters.

II. RECOMMENDED SOLUTION

A. It is recommended that two separate fire alarm systems be installed; one in the LCSB including the access shaft and one in the LCEB. The systems will be as follows:

(Continued)

II. A. (Continued)

1. LCSB System

   a. The LCSB system will contain a fire detection loop consisting of fixed temperature, rate of rise type fire detectors with at least one detector installed in each divided area of the LCSB and access shaft in accordance with National Board of Fire Underwriters' Standard No. 72.
   b. Non-coded, break-glass, pull-lever type manual stations will be installed, in the fire detection loop, near each of the two entrance ways. Each manual station will contain a 6-inch vibrating bell.
   c. A Control Panel of the non-coded, supervised type will be mounted in a locked steel cabinet, located in the security room. The Control Panel will contain the control relays and a fire indicating light and a 6-inch vibrating bell with a bell silencing switch. A light in the panel will indicate that the alarm bell has been silenced. A reset switch will reinstate the alarm system after fire condition is corrected. A test switch will permit simulation of a fire condition. The panel will initiate a signal to the Monitor and Alarm Panel, in the LCC, to indicate a fire condition in the LCSB.
   d. The fire detection loop will be electrically supervised against breaks and grounds in the loop. A trouble indicating light and buzzer, with a buzzer silencing switch, will be installed in the Control Panel.
   e. Power to activate the LCSB system will normally be supplied from the essential bus of the Main Distribution Panel at 480 vac, single phase, 60 cycle. The Fire Control Panel will be equipped with a transformer/rectifier to supply 12 vdc to the detection loop and the control circuit. A 12 vdc storage battery will automatically supply power to activate the system for a period of 60 hours in the event of a primary power outage. A trickle charger will be supplied to maintain a full charge on the battery during normal operating periods. Indicating lights in the Control Panel will indicate when the system is on battery power, or on A.C. power.

2. LCEB System

   a. Equipment and power used by the LCEB system will be functionally identical to that used in the LCSB system. The difference being in the location of the components.
   b. A fire detection loop will be installed in the LCEB with a manual station located in the Tunnel Junction near the sump pump.
   c. A Control Panel in the LCEB will transmit signals to the Monitor and Alarm Panel in the LCC in the event of a fire, or trouble in the detection loop.

3. Detection of a fire in either system will illuminate an alarm light in the associated Control Panel, sound all alarm bells in that system and transmit a signal to the Monitor and Alarm Panel in the LCC and to the Control Panel in the LCSB. The alarm bells may be silenced at the respective Control Panel but the indicating light remains illuminated until the fire condition is corrected.

(Continued)

II.A. (Continued)

4. Major items of equipment are as follows:

   a. Fire detectors, fixed temperature, rate of rise, heat actuated.
   b. Control Panels, supervising type, non-coded.
   c. Manual stations, break glass, pull lever type.
   d. Fire alarm bells, 6-inch vibrating type.

NOTE

This Figure "A" is similar to Figure "A" 1328.3, except additional requirement for alternate power source.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A OPERATIONAL GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C POWER	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE 2-14-63	CONTRACT NO.
E 1329	F	G ELECTRICAL SYSTEM, LF	J AFBSD APP DATE 4-11-63	K AF 04(694)-266

L REVISIONS: Revision Date 1	Code 2	Initiated By 3	AFBSD Approval Date 4	M Functional Class Index	N Stock Number: Fed. Supply Class 1	Federal Item ID Number 2	Manufacturer's Part Number 3	P Basis of Issue and Quota Allocations: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod. Lead Time	X End Item Effectivity	Y Remarks
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists for a supply of alternating current power at the Launch Facility to operate the weapon system and its support services. This power shall be supplied at 480 volts, 3 phase, 3 wire 60 cycles. Provision to be made to transform an adequate amount to service loads requiring 120/208 volt, 3 phase, 4 wire 60 cycle power. Tolerances on LER power supply are as follows:

Voltage regulation	±10 percent
Steady state frequency regulation	±1-1/2 percent
Transient frequency regulation	±5 percent
Voltage modulation	±1 percent
Frequency modulation	±1 percent
Harmonic content	Less than 5 percent

To satisfy the requirement, the following conditions shall be fulfilled:

1. A supply of commercial power is required in the Launch Facility during normal operating period. The commercial power supply shall be furnished from an overhead pole line terminating outside the security fence, and brought into the LEB in underground conduit. Lighting and overload protection is required for the commercial power feeders. All electrical services entering the hardened facilities shall be electro-magnetic pulse shielded, and protected against lightning and the effects of a nuclear detonation as defined in facilities criteria for WS-133B, LF.

(Continued)

Remarks: 2.57, 2.57.1, 2.57.2, 2.57.3, 2.57.4, 2.57.5, 2.57.6, 2.57.7, 2.57.8, 2.57.9, 2.57.10, 2.57.11, 2.57.12, 2.57.13, 2.57.14, 2.57.15, 2.57.16, 2.57.17, 2.57.18, 2.57.19, 2.57.20, 2.57.21, 2.57.23, 2.57.24, 2.57.25, 2.57.26, 2.57.27, 2.57.28

I. A. (Continued)

2. An engine driven generator set is required to provide standby power in event of deterioration or failure of commercial power supply. The engine generator shall be adequately sized to provide power to those electrical circuits that are mandatory to maintain weapon system alert status. Power characteristics shall be as mentioned above. The engine generator shall have all necessary controls for automatic starting and stopping and shall have the capability of continuous unattended operation for the standby emergency period including sufficient lubricating oil and filter capacity for oil and fuel. The following controls and monitoring are required:

a. Automatically excercise the standby unit for a period of two hours at two week intervals.
b. Sense and cause shutdown of unit when any of the following conditions occur:

(1) High jacket water temperature.
(2) Low lubricating oil pressure.
(3) Engine overspeed.
(4) Closed blast valve.

c. Provide a visual display in the LEB of the following conditions:

(1) High temperature of water in engine water jacket.
(2) Low lubricating oil pressure.
(3) Engine overspeed.
(4) Low fuel level in storage tank.
(5) Low fuel level in day tank.
(6) Engine failure to start.

d. Provide control panels for both engine and generator with necessary instruments and control devices as follows:

(1) Lubricating oil pressure gage.
(2) Engine throttle.
(3) Jacket water temperature gage.
(4) Running time meter.
(5) Frequency meter.
(6) Voltmeter with 8 position phase selector switch.
(7) Ammeter with 4 position phase selector switch.
(8) Voltage regulator rheostat.
(9) OFF-MANUAL-AUTOMATIC-TEST 4-position switch.
(10) Emergency stop push button.

e. Sense and transmit signal to C-163 Data Converter for following conditions:

(1) Diesel engine generator set operating.
(2) Loss of primary power.

(Continued)

2.57.29
2.57.30
2.57.31
2.57.32
2.57.33
2.57.34
2.57.35
2.57.36
2.57.37
2.57.38
2.57.39
2.57.40
2.57.41
2.57.42
2.57.43
2.57.44
2.57.45
2.57.46
2.57.47
2.57.48
2.57.49

I. A. 2 (Continued)

f. Transmit signal to C-163 Signal Data Converter (Figure "A" 13000) for the following conditions:

(1) Low fuel level in storage tank.
(2) Low fuel level in day tank.

g. Provide for engine starting as follows:

(1) Engine cranking panel.
(2) Starting motor.
(3) Starting battery.
(4) Starting battery charger.

h. Provide protection for overload of generator.

3. Controls are required to sense the status of the commercial power and to automatically start the standby generator and to transfer loads from commercial power to standby power under the following conditions:

a. Standby engine generator to be started if commercial power voltage falls below 90 percent of nominal value or the frequency falls outside the range of 60 ± 1-1/2 percent cycles for an adjustable period of 0 - 1 minute or when single phasing of the commercial power occurs.
b. The loads to be transferred to the standby set when its voltage has reached a value of 90 percent of nominal and frequency reaches 61 (± 1) cycle per second.
c. If the commercial power returns to acceptable values before transfer of load, the load shall remain connected to the commercial power source and the standby engine generator returned to standby status.
d. When the commercial power returns to acceptable values the loads shall be retransferred to the commercial power source and, after an adjustable time delay of 2 - 30 minutes, the standby engine generator returned to standby status.

4. A distribution system with main and branch circuit and ground fault protection for all weapon system and supporting loads is required. The maximum voltage drop, main panel to load, shall not exceed 5 percent. Power neutral shall be grounded and shall be carried insulated throughout the facility. Communication and signal lines shall be separated from power lines by a minimum of 24 inches. Power shall be distributed as follows:

a. Power to Launcher Equipment Building loads shall include but not be limited to the following:

(1) 120/208-volt, 3-phase, 60-cycle power for maintenance vehicles with receptacles compatible with plugs on the following:

(a) Semitrailer, Guidance Control Re-entry Vehicle (Figure "A" 4024).

(Continued)

I. A. 4. a. (1) (Continued)

(b) Truck, Mechanical Maintenance (Figure "A" 4031).
(c) Semitrailer, Transporter-Erector (Figure "A" 4059).
(d) Truck, Targeting (Figure "A" 4062).
(e) Truck, Electronic Maintenance (Figure "A" 4063).
(f) Hydraulic Pusher Set (Figure "A" 4640).

(2) 480-volt, 3-phase, 60-cycle power for operation of Personnel Access Hatch Closure (refer to Drawing No.).
(3) 120-volt, single phase, 60-cycle power for floodlighting (Figure "A" 1331).
(4) 480-volt, single phase, 60-cycle power for heating lubricating oil and water in Engine Generator Set.
(5) 480-volt, 3-phase, 60-cycle power for Refrigeration System (Figure "A" 1211).
(6) 480-volt, 3-phase, 60-cycle power for Air Intake System (Figure "A" 1389).
(7) 480-volt, 3-phase, 60-cycle power for Air Exhaust System (Figure "A" 1389).
(8) 120-volt, single phase, 60-cycle power for lighting and receptacle loads in LEB.
(9) 480-volt, 3-phase, 60-cycle power for Air Compressor (Figure "A" 1211).
(10) 480-volt, 3-phase, 60-cycle power for Dryer-Air, Compressor, Hardened Cable (Figure "A" 1207).
(11) 480-volt, 3-phase, 60-cycle power for Water Control and Removal System (Figure "A" 1209).
(12) 120-volt, single phase, 60-cycle power for Fuel Transfer Pump (Figure "A" 1405).
(13) 120-volt, single phase, 60-cycle power for Engine Starter Battery Charger.
(14) 120-volt, single phase, 60-cycle power for MCN telephones.
(15) Provide 10 percent spare circuit capacity for future loads in LEB.
(16) 480-volt, 3-phase, 60-cycle power for Blast Valve Control System.
(17) 208-volt, 3-phase, 60-cycle power for Launcher makeup air fan (Figure "A" 1211).

b. Power to loads in Launcher shall include but not be limited to the following:

(1) 120-volt, single phase, 60-cycle power for Winch Motor (Figure "A" 4043).
(2) 120-volt, single phase, 60-cycle power for Personnel Access Hatch Control (refer to Drawing No.).
(3) 120-volt, single phase, 60-cycle power for maintenance equipment in Launcher.
(4) 120-volt, single phase, 60-cycle power for lighting in Launcher.
(5) 208-volt, 3-phase, 60-cycle power for Water Control and Removal System in Launcher (Figure "A" 1209).
(6) 208-volt, single phase, 60-cycle power for Launch Tube heater.
(7) 208-volt, 3-phase, 60-cycle power for Electromechanical Actuator (refer to Drawing No.).

(Continued)

I. A. 4. b. (Continued)

(8) 208-volt, 3-phase, 60-cycle power for Cooler, Liquid, Guidance Section (Figure "A" 1214).
(9) 120/208-volt, 3-phase, 60-cycle power for a-c/d-c converter (Figure "A" 5002).
(10) 120-volt, single phase, 60-cycle power for Support, Missile Suspension and Alignment System (Figure "A" 1322).
(11) Provide 10 percent spare circuit capacity for future loads in Launcher.
(12) 208-volt, 3-phase, 60-cycle power for air-handling unit (Figure "A" 1211).

5. A requirement exists for a Launch Facility grounding system consisting of a counterpoise and grounding subsystems. The counterpoise shall be the primary earth ground of the facility to which all grounding subsystems will finally connect, except grounds for lightning rods and pole mounted lightning arresters. The resistance of the counterpoise to ground shall not exceed 5 ohms. A Launcher grounding point (LGP) shall be provided in the Launcher Equipment Room to which the following grounding subsystems shall be connected.

a. Electronic equipment.
b. Structures (Launcher and LEB).
c. Lightning (except pole-mounted lightning arresters).
d. Primary power neutral.

The Launcher Grounding Point shall be connected to Launch Facility ground point.

Lightning rods near surveillance antennas shall be connected to ground rods near the base of the lightning rod supports.

Vehicle grounding tie points shall also be connected to the counterpoise (LFGP).

Electronic grounding subsystem, prior to connection, shall have a minimum resistance of 1 megohm to ground. The LGP, LFGP and all interconnecting conductors shall withstand the weapons effects as stated in D2-30081.

B. Design Constraints

1. Power

Not applicable.

2. Physical

Not applicable.

(Continued)

I. B. (Continued)

3. Interface

Commercial power company shall make power available at the take-off pole at 480 volts, 3 phase, 60 cycles, 3 wire, delta connected secondary.

4. Environmental

a. Ambient

(1) Temperature +40 F deg to +122 F deg.
(2) Altitude 0 to 7000 feet above sea level.

b. Dynamic

Not applicable.

5. Weapons Effect

Refer to Weapons Effects Criteria Exhibit 62-83.

6. Monitoring

Refer to part IA2 of this document.

7. Operating Life

The diesel engine generator set shall be designed for and provided with necessary auxiliary equipment to operate unattended continuously for the standby emergency period.

8. Safety Requirements

The diesel engine generator set shall shut down if any of the following conditions exist:

a. High jacket water temperature (critically high).
b. Low lubricating oil pressure (critically low).
c. Engine overspeeds.
d. Blast valve closed.

9. Special Considerations

Not applicable.

(Continued)

I. (Continued)

C. <u>Operability and Maintainability</u>

The system shall be designed that a minimum amount of down time is required to correct a malfunction. Malfunctioning component parts or subasseebmlies shall be easily isolated and replaced.

D. <u>Reliability</u>

E. <u>Applicable Documents</u>

D2-30081 Facilities Criteria for WS-133B LF.
AF/BSD Exhibit 62-77 Electric Power and Cabling Subsystem Design Criteria for WS-133B Minuteman.
AF/BSD Exhibit 62-75 Electrical Grounding Criteria for WS-133B Minuteman Weapon System.
AF/BSD Exhibit 62-82 Weapon System Safety Criteria Exhibit WS-133B.

II. RECOMMENDED SOLUTION

Two sources of electrical power will be as follows:

A. Commercial alternating current power will be supplied at 480 (± 5 percent) volts, 3 phase, 60 (± 1-1/2 percent) cycles, 3 wire, delta connected secondary with less than 5-percent RMS harmonics. Power will be furnished by a local power company to a power takeoff pole located 15 to 25 feet outside of the security fence. Feeders to high voltage side of transformers will be protected with 3 phase lightning arresters mounted on pole and grounded at base of pole. Feeders from low voltage side of transformers will be protected with 3 phase lightning arresters mounted on pole, and grounded to feeder conduit. Cables to be run underground from pole to Launcher Equipment Building. Voltage surges caused by nuclear detonations or lightning will be passed to ground by lightning arresters connected to the incoming power lines and the Launcher grounding point. Electromagnetic pulse and RFI protection will be provided for by a steel liner completely enclosing the interior of the Launcher Tube and Equipment Room.

(Continued)

II. (Continued)

B. A 100 kw, 0.8 power factor, 3-phase, 60-cycle, 480/277-volt, wye connected grounded neutral, 4-wire diesel engine generator set with automatic start and stop control will be supplied as a standby source during periods of commercial power outage. Speed regulation will be governed within the 1.5 percent limitation. The standby set and its auxiliaries will be devoid of radio interference generating capability as defined in Facilities Criteria for WS-133B, LF, D2-30081. Integrated load sequencing will be provided to facilitate transfer of electrical loads to standby set. The auxiliaries of the engine generator set will include:

1. An engine instrument panel, with the following equipment as a minimum:

   a. Lubricating oil pressure gage.
   b. Engine throttle.
   c. Jacket water temperature gage.
   d. Emergency stop push button.

2. A generator control and instrument panel, with the following equipment as a minimum:

   a. Running time meter.
   b. Frequency meter.
   c. A-C voltmeter with 8 position phase selector switch, connected to indicate voltage of both standby and commercial power.
   d. A-C ammeter with 4 position phase selector switch.
   e. Voltage regulator rheostat.
   f. 4 position selector switch, MANUAL-AUTOMATIC-TEST-OFF.

3. A Visual Fault Display Panel with the following identified indicating lights:

   a. High water temperature.
   b. Low lubricating oil pressure.
   c. Engine overspeed.
   d. Low fuel level in storage tank.
   e. Low fuel level in day tank.
   f. Engine failure to start.

4. An Engine Cranking Panel to function as follows:

   a. To initiate a cranking cycle on loss or deterioration of commercial power.
   b. To initiate a cranking cycle when 4 position selector switch on Generator Control and Instrument Panel is placed in MANUAL or TEST position.

(Continued)

II. B. 4. (Continued)

c. Cranking cycle to consist of ten 10 second cranking periods alternating with 10 second rest periods. If engine does not start after tenth cranking period, the controls will lockout and send signal to Visual Fault Display Panel.

d. After startup a starting solenoid shall disconnect starting motor.

5. A electric starting motor controlled by the Cranking Panel shall have a solenoid or inertia type mechanism.

6. A starting battery shall be a stationary industrial, lead-acid 24-volt nominal, storage battery with adequate capacity to simultaneously provide the following services in an ambient temperature of 40 deg F:

a. A minimum of ten starting attempts of 10 seconds duration each and separated by 10 second time intervals.

b. Provide control power for Cranking Panel.

c. Provide power to Engine Instrument Panel.

7. A battery charger to maintain the starting battery fully charged at float voltage recommended by battery manufacturer. Input to the charger shall be 120-volt, single phase, 60-cycle power with maximum output of 12 ampere.

8. A reserve lubricating oil tank shall be provided. Tank shall be of sufficient capacity to supply the standby generator set with oil throughout the emergency standby period. Automatic control of oil feed to engine crankcase shall be provided through adequate filters.

C. Two electrically operated, mechanically interlocked, draw-out type air circuit breakers will be provided for transferring loads from commercial to standby power or vice versa and for providing circuit protection for commercial and standby main feeders. Auxiliary devices will perform the following functions:

1. Start the diesel engine automatically if commercial power voltage falls below 90 percent nominal for an adjustable period of 0 - 1 minute, or when frequency is not within 60 ± 1-1/2 percent cycles per second, or when single phasing of the commercial power occurs.

2. Transfer the loads to the standby generator, when generator voltage reaches 90 percent nominal and frequency is 61 (± 1) cycles per second. Load sequencing will be provided through time delays and contactors as needed.

3. Load will not transfer to standby set if commercial power returns to acceptable values before the standby power has reached transfer values. Engine will shut down automatically after a preset period.

(Continued)

II.C. (Continued)

4. Retransfer load from standby to commercial power automatically when commercial power reaches acceptable values and after an adjustable time delay, with subsequent engine shutdown.

5. Provide a control which will automatically start the diesel engine every 14 days and initiate transfer of load from commercial to standby, operate for 2 hours, and initiate transfer of load from standby to commercial power, if available, and finally stop engine.

6. Sensors shall be provided and connected into control circuitry to automatically shutdown the diesel engine if any of the following malfunctions occur:

   a. Low lubricating oil pressure.
   b. High jacket water temperature.
   c. Engine overspeed.
   d. Blast valve is closed.

7. Sensors shall be provided to initiate a signal to the C-163 data converter if any of the following conditions exist:

   a. Loss of primary power.
   b. Diesel engine generator set in operation.

8. Relays shall be provided to initiate a signal to the C-163 data converter if any of the following conditions exist:

   a. Low fuel level in storage tank.
   b. Low fuel level in day tank.

D. A power distribution system will be installed in the Launch Facility to distribute power and provide individual circuit protection. The Main Distribution Panels will provide power and protection to subpanels and junction boxes which will service all equipment in the facility as itemized in step 4 of Technical Requirements.

A grounding transformer will be provided to give ground fault protection to the 480 volt system.

A 480 to 208Y/120 volt transformer will be provided for loads requiring 120 and/or 208 volts.

A minimum separation of 24 inches will be maintained between power lines and signal or communications circuit when possible.

(Continued)

II. D. (Continued)

Maximum voltage drop transformers to loads will not exceed 5 percent. Power circuits entering the Launch Facility will be protected as follows:

1. Voltage surges caused by nuclear detonation or lightning will be passed to ground by lightning arresters connected to incoming power lines and the Launcher Tube and Equipment Room.

2. All power conductors leaving the cable protective enclosure frame shall be filtered before entering the LER.

E. The grounding counterpoise will be galvanized steel plates at base of LEB access shaft; enough plate being used to bring total ground resistance down to 5 ohms. The Launch Facility Ground Point (LFGP) will be located at the approximate center of the counterpoise. A Launcher Grounding Point (LGP) will be provided in the Launcher Equipment Room. The LGP and LFGP will be connected by at least two insulated conductors, each of which is at least equivalent to 4/0 copper wire in conductivity, and shall be capable of surviving weapons effects as defined in D2-30081.

1. The electronic equipment ground will be furnished by others.

2. The structures ground in the Launcher will consist of a 4/0 copper bus, or equivalent, nonlooped, mounted on the inner surface of the outer wall of the Launcher Equipment Room to which steel structures, equipment cases, platforms and nonelectrical equipment will be grounded. The structures ground will be connected to the LGP.

3. The common of the surge arresters in the LEB will be connected to the LEB equipment ground.

4. The neutral of the grounding transformer on the commercial power feeder will be connected to the LEB equipment ground. The neutral of the 120/208 volt system will be grounded to the LEB equipment ground by a single connection at the 480-208Y/120 volt transformer.

5. Vehicle static grounds will be connected directly to the nearest convenient point of the counterpoise.

Electronic Grounding Subsystem will have a minimum resistance of 1 megohm to ground before connection.

F. Major items of equipment are:

1. Class 3, 35-foot wood pole.

2. 3 wire lightning arresters.

(Continued)

II.F. (Continued)

3. Cross arms with mounting hardware.
4. Conduit and fittings.
5. Underground conduit and wiring.
6. 100 kw diesel engine generator set complete with panels for control and instrumentation.
7. Cranking Panel and starting motor.
8. Starting battery and charger.
9. Fault Display Panel.
10. Interference suppression filters.
11. Surge arresters.
12. Grounding conductors.
13. Grounding transformer.
14. Two mechanically interlocked, electrically operated air circuit breakers and controls.
15. Main and submain circuit breaker panels.
16. 480 to 208Y/120 volt transformer.

NOTE

This document is similar to Figure "A" 1329.3 except for the addition of 480 volt distribution, increased loads, and relocation of equipment. The automatic transfer switch unit was replaced by the interlocked electrically operated circuit breakers.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 1330	F	G SHOCK ATTENUATION SYSTEM, LAUNCHER (EQUIPMENT ROOM)	2-14-63	K AF 04(694)-266
			J AFBSD APP DATE 4-11-63	

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	2.58.3.15 2.58.3.16 2.58.3.17 2.58.3.18 2.58.3.19 2.58.3.20

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide an isolated platform for mounting shock sensitive equipment in the Launcher equipment room. A requirement also exists to provide special shock mounting assemblies and flexible interconnections for miscellaneous equipment not mounted on the shock-isolated floor.

B. Design Constraints

1. Power

Not applicable.

2. Physical

a. Isolated Platform Structure

A structural steel, shock-isolated platform is required to provide shock protection for shock-sensitive weapon system equipment. The platform will be sized to accommodate mounting provisions and space for the following:

(1) ESA junction box.
(2) D-C power rack.
(3) Frequency transmitter and receiver rack.
(4) Message processing and control rack.
(5) Voice and data terminal rack.

(Continued)

I. B. 2. a(Continued)

(6) C-169 rack.
(7) C-225 rack.
(8) G&C cooler rack.
(9) Monitor power supply rack.
(10) Spare rack.
(11) Umbilical junction box.
(12) Air-conditioning unit.
(13) Support attachments for suspension system (Figure "A").
(14) Access for maintenance and MGE to equipment mounted on isolated platform structure and adjacent fixed structures.
(15) See D2-30081.

b. Mounting Provisions

There shall be a means of attaching the shock isolators (Figure "A" 5006) to the platform structure and to the hardened building structure.

c. Flexible Interconnections

All system interconnections between rigid mounted equipment/junctions and isolated platform structure will be sufficiently flexible to introduce no significant restraint to the motion of the platform. Required connections will include:

(1) Environmental control ducting.
(2) Electrical distribution conduits.
(3) Fluid transmission piping.
(4) Communication and antenna cables.

d. Miscellaneous Equipment

Miscellaneous items, attached to the hardened structure, require special mounting assemblies, to attenuate shock forces to safe levels for the equipment/components.

(1) Emergency batteries.
(2) Cable trays not on shock-isolated floor.
(3) Environmental control units and Remote Control Panels.
(4) Launcher Distribution Panel.
(5) Lighting fixtures.
(6) Support, Missile Suspension and Alignment System (Figure "A" 1322).
(7) Hardened communication cables.

(Continued)

REV SYM B

I. B. (Continued)

3. <u>Interface</u>

The shock Attenuation System will interface the following:

a. Launcher equipment room structure.
b. Shock isolators (Figure "A" 5006).
c. Launcher grounding system (see D2-30081).
d. Weapon system equipment (OGE and RPIE).

4. <u>Environmental</u>

a. <u>Ambient</u>

The Shock Attenuation System will resist all degrading effects of climatic conditions (see D2-30081).

b. <u>Dynamic</u>

The Shock Attenuation System will withstand without damage the maximum ground shock motions arising from specified weapons effects criteria (see D2-30081).

5. <u>Weapon Effects</u>

Ground shock (see Response Spectra and D2-30081).

6. <u>Monitoring</u>

Not applicable.

7. <u>Operating Life</u>

See D2-30081.

8. <u>Safety Considerations</u>

Not applicable.

9. <u>Special Considerations</u>

For finishes, see D2-30081.

(Continued)

I. (Continued)

C. Operability and Maintainability

See D2-30081.

D. Reliability

E. Applicable Documents

D2-30081 Facilities Criteria for WS-133B Launch Facility, Operational.

II. RECOMMENDED SOLUTION

It is recommended that a system be provided to protect the weapon system equipment in the Launcher equipment room from intolerable forces resulting from ground shock. The integrated system will provide protection as follows:

A. A shock attenuated platform will be suspended in the equipment room, in plane, and parallel with first level flooring. Platform will utilise space between hardened equipment room wall and Launcher Tube liner and will include space for equipment listed under IE2a, maintenance access and MGE. Provisions for the platform will include:

1. An annular, structural platform with allowance for vertical and horizontal rattle space and hinged bridge plates for access to provide floor continuity.

2. Mounting brackets will be provided in roof slab and on the platform. The brackets will be compatible with the design of the shock isolators (Figure "A" 5006).

B. Miscellaneous hard-mounted equipment will be isolated from direct or induced shock effects by means of shock-attenuating mounts, as follows:

1. Emergency batteries will be mounted on rubber blocks. Peripheral travel will be limited by additional rubber blocks on adjacent structure/equipment.

(Continued)

II. B (Continued)

2. Hard-mounted cable trays will be shock-isolated from structural mounting points by rubber blocks as necessary.

3. The Launcher Heating and Ventilating Remote Control Panels will be provided with rubber blocks at structural mounting points.

4. All illumination fixtures, not attached to shock isolated platform will be provided with tension-spring hangers.

5. The Launcher Distribution Panel will be provided with rubber blocks for attachment to hardened equipment room wall and floor.

C. All system interconnections will be flexible to shock-isolated equipment/components, as follows:

1. All interconnection of hard-mounted environmental ductwork and shock-isolated equipment will be flexible duct/connector type.

2. All interconnection of shock-isolated Equipment/Electrical Panels and electrical transmission media will be flexible conduit type.

3. All interconnection of shock-isolated equipment and fluid transmission pipes will be flexible hose type.

D. The hardened communication and antenna cables will be protected from shock effects at entrance to Launcher. The case will be anchored at outer wall of penetration and will envelope the conduit outboard for a designed distance to provide support in the transition from motion of the structure to motion of the ground.

E. Mounting plates will be firmly imbedded and attached to the Launcher Tube inner wall for the installation of Support, Missile, Suspension and Alignment System (Figure "A" 1322).

F. The Shock Attenuation System will contain the following equipment:

1. Structural mounting platform.

2. Rubber shock mounts for emergency batteries, cable trays and the Launcher Distribution Panel.

3. Shock mounting for hard-mounted illumination fixtures.

4. Flexible ducts and connections.

5. Flexible conduit.

(Continued)

II. F. (Continued)

6. Flexible hose.

7. Brackets for shock isolators.

8. Mounting plates for the Missile Suspension System.

NOTE

This Figure "A" is similar to Figure "A" 1330.3 except for increased size of platform to mount additional WS-133B equipment and deletion of sway dampers and shock isolators.

SHEET 6 OF 6 NOMENCLATURE SHOCK ATTENUATION SYSTEM, LAUNCHER (EQUIPMENT ROOM) FIGURE A NUMBER 1330

2-68340-6

A. TYPE OF LIST	B. MODEL DESIGNATION	C. SUB SYSTEM IDENTIFICATION	D. CONTRACTOR
REAL PROPERTY INSTALLED EQUIPMENT	SM-80 WEAPON SYSTEM	SECURITY	THE BOEING COMPANY

E. FIGURE A NUMBER	F. MILITARY NOMENCLATURE AND FED. MFR'S CODE	G. COMMON NOMENCLATURE	H. ORIGINATION DATE / J. AFBSD APP DATE	K. CONTRACT NO.
1331		SECURITY SYSTEM, LF	2-14-63 / 4-11-63	AF 04(694)-266

L. REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M. FUNCTIONAL CLASS INDEX	N. STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P. BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q. TOTAL ON ORDER	R. ESTIMATED UNIT PRICE	S. ESTIMATED TOTAL PRICE	T. COGN. LAB CENTER & SERVICE	U. PROPOSED SOURCE OF SUPPLY	V. SOURCE CODE	W. EST. PROD. LEAD TIME	X. END ITEM EFFECTIVITY	Y. REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide the Launcher sites with continuous protection against unauthorized intrusion. Security status violations shall be sensed and transmitted to the LCC. A security system shall be provided which shall meet the following requirements:

1. The security compound shall be completely enclosed and shall have a single access for personnel and equipment. The access closure shall be manually operable and shall be equipped with a padlock. The enclosure shall be protected against the entry of animals. Opening of the access closure, shall be sensed, and an outer zone security violation signal shall be initiated to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

2. Launcher Equipment Building functional. equipment and personnel access closures shall be provided with locking devices. Any movement of these closures from the closed position shall be detected, and a security violation signal shall be transmitted to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

3. The hardened Launcher shall have the following inner zone security provisions:

   a. Provide support facilities for mounting a positive latching device for the Launcher Tube closure with status monitoring circuit.
   b. Movement of the Launcher Tube closure from the closed position shall be sensed.
   c. Movement of the sight tube closure from the closed position shall be sensed.
   d. Preclude and detect entry through personnel access shaft (refer to Drawing).
   e. Detect attempts to penetrate walls of the Launcher Tube and/or equipment room.
   f. Violation signals from the above detecting devices shall be transmitted to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

(Continued)

Remarks: 2.59.1, 2.59.2, 2.59.3, 2.59.4, 2.59.5, 2.59.6, 2.59.7, 2.59.8, 2.59.9, 2.59.10, 2.59.11, 2.59.12, 2.59.13, 2.59.14, 2.59.15, 2.59.16, 2.59.17, 2.59.18, 2.59.19, 2.59.20, 2.59.21, 2.59.22

1. A. (Continued)

4. A requirement exists to transmit alarm signals from both the inner and outer security zones to a common junction in the Launcher equipment room. Outer zone security violation signals from the closure status circuits shall be assembled in a transmission junction in the Launcher Equipment Building. The transmission junction shall include a provision for mounting a test receptacle (Figure "A"). Signals shall then be transmitted to the Launcher equipment room.

   A common junction shall be provided in the Launcher equipment room for inner and outer zone security monitoring circuits. Provision shall be included for mounting a receptable which is compatible with connector plug on the intrasite cable system (Figure "A" 1248) for connecting circuits in the junction to the Alarm Set Group. Anti-Intrusion, Restricted Area (Figure "A" 1296). A provision shall be made to mount a test receptacle (Figure "A").

5. Facilities shall be provided to support the installation and operation of a system for continuous surveillance of the sensitive security compound area. Adequate illumination of the sensitive area shall be provided. Restricted control of the illumination shall be provided at the security fence gate.

B. Design Constraints

1. Power

   a. 120-volts, single-phase, 60-cycle electrical power is required for surveillance lights.
   b. Electrical power and circuitry for detection system shall be compatible with Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

2. Physical

   The design concept of this equipment shall be similar to that of Figure "A" 1331.2 Revision Basic for Security System, Launcher with modifications limited to interface changes needed to meet Wing VI requirements.

3. Interface

   a. Electrical power for surveillance floodlights shall interface with Electrical System, LF (Figure "A" 1329) to give 0.5 foot-candles of lighting over the area.
   b. Intrusion detection system shall interface with Alarm-Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

(Continued)

I. B. (Continued)

4. <u>Environmental</u>

Not applicable

5. <u>Weapons Effects</u>

See D2-30081

6. <u>Monitoring</u>

a. Inner or outer security violation signals are transmitted to the operator's console in LCC.
b. Provision shall be made to test capability of position sensitive switches to generate security violation signal.

7. <u>Operating Life</u>

Not applicable

8. <u>Safety Considerations</u>

Not applicable

C. <u>Operability and Maintainability</u>

Not applicable

D. <u>Reliability</u>

E. <u>Applicable Documents</u>

D2-30081 Facilities Criteria for WS-133B, LF.

(Continued)

(Continued)

II. RECOMMENDED SOLUTION

A security system will be provided to protect the Launcher against unauthorised intrusion. The system will include the following components:

A. The Launch Site will be enclosed with a chain-link fabric fence mounted on tubular posts. Strands of barbed wire will be strung on post top outriggers. A hinged, biparting tubular frame gate complete with hardware will be provided. Gate will be provided with mechanical latches and will be secured with a commercial padlock. A mesh animal barrier will be installed beneath the fence and gate to a minimum depth of 1 foot, 4 inches below Grade. A position sensitive assembly will be provided to furnish a remote indication when the gate is open.

B. Personnel access hatches, and intake and exhaust air and gas gratings will be provided with conventional hasps and commercial padlocks. Equipment hatches will be secured in place by a locking device. Position sensitive assemblies will provide a remote indication of a hatch or grating position.

All position sensitive assemblies in the LEB will be connected to transmit a security violation signal to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

C. The following provisions will furnish security for the hardened Launcher:

1. Mounting facilities will be provided for the Launcher Tube closure latch. Conduit will be provided for the latch monitoring switch to transmit security violation signals to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

2. A position sensitive assembly will be provided to detect movement of the Launcher Tube closure from the closed position. A junction box will be provided for mounting the position sensitive assembly. The assembly will initiate a security violation signal to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

3. A position sensitive assembly will be provided to detect movement of the sight tube closure from its closed position.

(Continued)

II. C. (Continued)

4. For provisions to preclude and detect entry through the Launcher personnel hatch see Drawing.

5. Junction boxes will be provided for mounting vibration transducers in the Launcher.

6. A conduit system will be provided to transmit security violation signals from transducers to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

D. A terminal cabinet will be mounted in the LEB to serve as a common transmission junction for all outer zone security violation signals from the closure status circuits. The cabinet will contain terminal strips and will include a hole and bolt holes on one side of cabinet for mounting a test receptacle. A conduit system will be provided to transmit signals from the junction to the Launcher equipment room.

A terminal cabinet will be provided in the Launcher equipment room to serve as a common junction for all inner zone and outer zone security monitoring circuits. The cabinet will be equipped with terminal strips and will contain a hole and bolt holes on the bottom of the cabinet for mounting a test receptacle. (Figure "A"). The cabinet will also contain mounting provisions for a receptacle which is compatible with the connector plug on the intrasite cable system (Figure "A").

E. Three antenna mounting facilities and three passive reflectors will be provided to support the installation and operation of the surveillance system. A conduit system will be provided for cables to connect the surveillance system to the Alarm Set Group, Anti-Intrusion, Restricted Area (Figure "A" 1296).

A floodlight fixture with 500-watt lamp will be provided for each designated pole. A key operated, maintain contact switch in a weatherproof enclosure will be mounted on the security fence near the access gate. An enclosed magnetic contactor will be mounted in an LEB terminal cabinet. A conduit system with conductors will connect the lights to two 120-volt, single-phase, 60-cycle circuits (Figure "A" 1329).

F. Major items of equipment are as follows:

1. Chain link fence, posts, gate, barbed wire fixtures, and hardware.

2. Standard commercial latches and locks.

(Continued)

II. F. (Continued)

3. Weapon system peculiar latches and locks.
4. Floodlights with mounting attachments, magnetic contactor and switch.
5. Position sensitive switches.
6. Passive reflectors.
7. Mounting pads for surveillance antennas.
8. 14- by 12- by 6-inch terminal cabinet.
9. 18- by 18- by 6-inch terminal cabinet.
10. Conduit, fittings, junction boxes, attachment hardware and conductors.

NOTE

This Figure "A" is similar to Figure "A" 1331.2 except for the new security requirements for the LEB.

SHEET 6 OF 6 NOMENCLATURE SECURITY SYSTEM, LF FIGURE A NUMBER 1331

2-4834-0-6

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C LIFE SUPPORT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO.
E 1333	F	G PERSONNEL SUPPORT EQUIPMENT, LCSB	2-14-63 / 4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63						1											RPIE			W-6	2.54.21 2.54.22 2.54.23 2.54.24 2.54.25 2.54.26 2.54.34 2.54.36

I. TECHNICAL REQUIREMENTS

A requirement exists at the Launch Control Support Building to provide the essential items to sustain life and to afford comfort for duty personnel. Provision shall be made for a total population of 14 men, including transients. Sleeping accommodations shall be provided for 19 men.

A. Provide kitchen facilities with adequate means for preparation of food.

B. Provide for semiautomatic disposal of waste from food preparation.

C. Provide capability for washing dishes and cooking and eating utensils.

D. Provide a means for cooling and dispensing drinking water.

E. Provide a means for disposing of personnel solid and liquid wastes. Provide capability for personal cleanliness.

F. Provide a fire fighting capability.

G. Provide storage capability in kitchen for dried and canned food and miscellaneous items.

II RECOMMENDED SOLUTION

The following equipment is recommended for the fulfillment of the personnel support requirements.

(Continued)

II. (Continued)

A. A built-in, electrically-operated unit, consisting of griddle, deep-fat fryer, range/oven (four-burner, medium duty, corrosion-resistantsteel) and food warmer. An exhaust hood and ducts will be installed over the entire unit for connection to the kitchen exhaust fan (Figure "A" 1390). Power: 208 volts, 60 cycles, 3 phase.

B. Two corrosion-resistant steel double sinks, one to be used for scullery and one for vegetable preparation. One sink will contain an integral electric garbage disposal unit. Power: 120 volts, 60 cycles, single phase.

C. A built-in, electrically operated dishwasher (commercial type, under counter, fully automatic, corrosion-resistant steel), complete with electric booster water heater for the rinse cycle of operation. Power: 120 volts, 60 cycle, single phase.

D. An electrically operated drinking water dispenser capable of providing chilled drinking water for personnel use. Power: 120 volts, 60 cycle, single phase.

E. Water closets, lavatories, shower stalls, mirrors, urinals, service sinks, water heater and associated hardware.

F. Two cabinet-mounted fire hoses connected to the water distribution system (Figure "A" 1324), and sized to deliver 70-gpm total flow at a minimum pressure of 25 psig for 30 minutes. Location and length of hoses will be such as to provide fire fighting capability throughout the LCSB.

G. Three steel base cabinets with shelves and one wall cabinet will be provided in the kitchen.

NOTE

This Figure "A" is similar to Figure "A" 1333.3 except for basic revisions.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C LIFE SUPPORT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE / J AFBSD APP DATE	CONTRACT NO.
E 1336	F	G OVEN-REFRIGERATOR, ELECTRIC, LCC	2-14-63 / 4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6 A	STL Review	4-11-63						1					3						RPIE			W-6	2.54.8 2.54.9

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

Facilities shall be provided to store and prepare food in the LCC for three men and shall meet the following requirements:

1. Space to store fresh food and to accommodate objects up to 12 inches in height. Space shall be lighted when door is open.

2. An easily cleaned work surface for preparing meals shall be at least 16 inches by 16 inches.

3. A means for cooking food by oven hotplate.

B. Design Constraints

1. Power.

Normal facility power, single phase, 120 volts, 60 cycles with twist-lock plug-in connection. Range switching shall minimize RFI generation.

2. Physical

Space envelope 30 inches wide by 24 inches deep by 45 inches high on shock-mounted platform for oven-refrigerator-hotplate. This unit shall be located inside of the shielded area.

(Continued)

I. B. (Continued)

3. <u>Interface</u>

This unit interfaces with the LCC electrical system and with the shock-mounted room.

4. <u>Environmental</u>

a. <u>Ambient</u>

The maximum ambient dry bulb temperature will be 78 deg F.

b. <u>Dynamic</u>

This unit shall be constructed and installed with fasteners that shall withstand the vertical and horizontal accelerations to which the attenuated platform may be subjected.

5. <u>Weapon Effects</u>

See D2-30082 Facilities Criteria for WS-133B LCF, Operational.

6. <u>Monitoring</u>

Not applicable

7. <u>Operating Life</u>

The minimum normal operating life shall be 10 years.

8. <u>Safety Considerations</u>

Not applicable

9. <u>Special Considerations</u>

a. The mounting of the mechanical unit shall be such that the noise generation is held to a minimum.
b. Provision must be made to dissipate the heat given off by the refrigeration unit.
c. Two convenience outlets shall be provided on oven-refrigerator-hotplate unit.
d. Oven door shall open upward and be provided with a closing latch and a lock-open device.
e. Oven shall be provided with an indicator light to show that oven has been turned on.
f. Consideration shall be given to hinging the doors to refrigerated compartments on the side adjacent to the compressor compartment.

(Continued)

I. (Continued)

C. Operability and Maintainability

1. Sufficient space shall be provided in front of the unit for easy access to food compartments.

2. Oven heating shall be thermostatically controlled.

3. The surface heating unit shall be controlled by a six-position switch.

4. Both refrigerated sections shall be defrosted automatically.

D. Reliability

Not applicable

E. Applicable Documents

1. Facilities for WS-133B LCF, Operational, D2-30082.

2. BSD Exhibit 62-79 Life Support Subsystem Criteria.

II. RECOMMENDED SOLUTION

A. A combination electrical oven, hotplate and refrigerator will be provided for duty personnel convenience. This unit satisfies the following conditions:

1. The oven shall be thermostatically controlled to 425 ±10 deg F, provided with a timer control and signal device and have space for three frozen meals per MIL-M-13966A or two standard commercially packed frozen meals.

2. The hotplate shall be of the rod type, approximately 6 inches diameter, and shall be controlled by a six-position switch.

3. The refrigerator of the food preparation unit will be comprised of two sections.

a. Upper space for frozen foods maintained at 0 ±10 deg F.
b. Lower space with section for tall objects to maximum height of 12 inches maintained at 38 ±5 deg F.

(Continued)

II. A. (Continued)

4. Refrigerator, oven and work surfaces will be stainless steel. A duplex utility outlet, hotplate switch, oven switch and indicating light will be provided on the back panel. Refrigerator compartments will be illuminated when open.

5. Power required: 120 volts, single phase, 60 cycles.

NOTE

This Figure "A" is identical to Figure "A" 1336.

SHEET 4 OF 4 NOMENCLATURE OVEN-REFRIGERATOR, ELECTRIC, LCC FIGURE A NUMBER 1336

2-68340-6

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 1390	F	G VENTILATION SYSTEM, LCSB	2-14-63	K AF 04(694)-266
			J AFBSD APP DATE 5-8-63	

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	5-8-63						1											RPIE			W-6	2.53.3 2.53.3.16 2.53.3.17 2.53.3.18 2.53.3.19 2.53.3.20 2.53.3.21 2.53.3.22

I. TECHNICAL REQUIREMENTS

A requirement exists to ventilate the LCSB to maintain efficient equipment operation and to provide personnel comfort.

A. <u>Functional Requirements</u>

1. A requirement exists to provide manually controlled ventilation for the kitchen, exhausting hot air generated during periods of food preparation. A source of fresh outside air shall be provided.

2. A requirement exists to ventilate the telephone equipment room to prevent overheating of equipment. Fresh, filtered outside air shall be supplied automatically when room temperature reaches 90 deg F.

3. A requirement exists to ventilate the water treatment room to prevent overheating of equipment. Fresh outside air shall be supplied automatically when room temperature reaches 90 deg F.

4. A requirement exists to provide manually controlled ventilation for the toilet room.

5. A requirement exists to provide ventilation for the utility room, utilizing outside air.

6. A requirement exists to provide ventilation for the Environmental System equipment room, utilizing outside air, and to provide an air supply for the Environmental System equipment (Figure "A"

(Continued)

I. A. (Continued)

7. A requirement exists to provide ventilation for the generator room, utilizing outside air, and to provide an air supply to the diesel generator for engine cooling and combustion.

B. <u>Design Constraints</u>

1. <u>Power</u>

120-volt, single-phase and 208- or 480-volt, 3 phase, 60-cycle power is available.

2. <u>Physical</u>

Not applicable.

3. <u>Interface</u>

a. Personnel Support Equipment, LCSB (Figure "A" 1333).
b. Ambient Atmospheric Environment Control, LCC (Figure "A"

4. <u>Environmental</u>

For natural environment see D2-30082.

5. <u>Weapons Effect</u>

Not applicable.

6. <u>Monitoring</u>

Not applicable.

7. <u>Special Considerations</u>

Not applicable.

C. <u>Operability and Maintainability</u>

1. Fan motors shall be equipped with manual starters with thermal overload protection and control device for manual and/or automatic operation.

(Continued)

I. C. (Continued)

2. Fan units shall be accessible for inspection, cleaning, and maintenance.

D. Reliability

Not applicable.

E. Applicable Documents

1. D2-30082, Facilities Criteria for WS-133B, LCF.

2. Air Force Manual 88-15, Facility Design and Construction.

II. RECOMMENDED SOLUTION

It is recommended that a ventilating system composed of independent subsystems be supplied to ventilate the Launch Control Center Support Building. The subsystems will consist of the following:

A. A powered roof ventilator and associated ductwork will be provided to exhaust hot air from the kitchen. The ventilator will be a low silhouette, V-belt driven centrifugal fan. The unit will be equipped with a backdraft damper and will be connected to the kitchen exhaust hood. The ventilator will be weatherproofed.

Manual control will be provided by a wall-mounted ON-OFF switch. A gravity roof ventilator will be provided to supply fresh outside air. The ventilator will be weatherproofed.

B. A centrifugal direct-drive fan will be provided to supply fresh, filtered outside air to the telephone equipment room. The fan will be thermostatically controlled to operate automatically when room temperature reaches 90 deg F. The fan will have a filter which is cleanable and replaceable. A gravity-type roof ventilator and ductwork will be provided for air intake. The unit will be weatherproofed. A pressure relief damper will be provided over the door to allow air exhaust during operation of ventilating fan.

(Continued)

II. (Continued)

C. A louver with a motor-operated damper will be provided to supply fresh outside air to the water treatment room. The motor will be thermostatically controlled to open the damper automatically when room temperature reaches 90 deg F. A gravity roof ventilator and associated ductwork will be provided to exhaust air from the room. The unit will be weatherproofed. A ceiling grille will be provided to admit air to the ventilator.

D. A powered roof ventilator and associated ductwork will be provided to exhaust air from the toilet room. The ventilator will be a low silhouette centrifugal fan. The unit will be equipped with a backdraft damper. The ventilator will be weatherproofed. Manual control will be provided by a wall-mounted ON-OFF switch.

E. Two louvers will be supplied in the outside wall of the building to allow natural cross-ventilation of the utility room.

F. Two louvers will be supplied in the outside wall of the building to allow outside air to the Environmental System equipment room for ventilation of the room and for supplying air to the Environmental System equipment (Figure "A"

G. Two motor-controlled dampers will be installed in the wall openings of the generator room to provide air for diesel generator operation. Bird-screened louvers will be installed in the exterior wall openings. The dampers will be interlocked with the diesel engine to open when the diesel engine starts. Associated ductwork will be installed and connected to the diesel radiator (Figure "A" 1437) with an exterior louver. The exhaust air will be controlled by an exhaust air damper which is modulated to maintain a constant jacket water temperature (Figure "A" 1437). Louvers and dampers must be protected against icing during cold weather.

H. The Ventilation System, LCSB will contain the following equipment:

1. Gravity roof ventilators.

2. Backdraft damper for powered roof ventilators.

3. Centrifugal supply fan, 120 volts, single phase, 60 cycles.

4. Air filter.

5. Louver and motor-operated damper, 120 volts, single phase, 60 cycles.

(Continued)

II. H. (Continued)

6. Thermostat control with relay and wiring.
7. Ceiling grille.
8. Powered roof ventilator, 120 volts, single phase, 60 cycles.
9. Powered roof ventilator, 208 volts, 3 phase, 60 cycles.
10. Ceiling register.
11. Louvers.
12. Ducts and connections.
13. Electrical circuitry and control switches.
14. Louvers and motor-operated dampers, 120 volts, single phase, 60 cycles.
15. Thermostat, immersion type.

NOTE

This Figure "A" is similar to Figure "A" 1390.3 except for changes to meet site conditions and ventilation requirements for the Environmental System equipment room and the generator room.

TYPE OF LIST: A. REAL PROPERTY INSTALLED EQUIPMENT

MODEL DESIGNATION: B. SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION: C. MONITOR RPIE

CONTRACTOR: D. THE BOEING COMPANY

FIGURE A NUMBER: E. 1396

MILITARY NOMENCLATURE AND FED. MFR'S CODE: F

COMMON NOMENCLATURE: G. MONITORING SYSTEM, EQUIPMENT FAULT, LCF

H. ORIGINATION DATE: 2-14-63

J. AFBSD APP DATE: 5-8-63

CONTRACT NO.: K. AF 04(694)-266

L. REVISIONS: Revision Date 1	Code 2	Initiated By 3	AFBSD Approval Date 4	M. Functional Class Index	N. Stock Number: Fed. Supply Class 1	Federal Item ID Number 2	Manufacturer's Part Number 3	P. Basis of Issue and Quota Allocations: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q. Total on Order	R. Estimated Unit Price	S. Estimated Total Price	T. Cogn. Lab Center & Service	U. Proposed Source of Supply	V. Source Code	W. Est. Prod. Lead Time	X. End Item Effectivity	Y. Remarks
2-22-63	6A	STL Review	5-8-63						1											RPIE			W-6	2.37.1 2.37.2 2.37.3 2.37.4 2.37.5 2.37.6 2.37.7 2.37.13 2.37.19 2.37.21 2.37.22 2.37.23 2.37.24

I. TECHNICAL REQUIREMENTS

A requirement exists to provide a system to monitor the operational status of critical equipment.

A. Functional Requirements

The system shall provide audible and/or visible alarms to denote malfunctions in, or status of, support equipment.

1. Provide a Monitoring Subsystem for the LCSB and soft facilities.

   a. Sense the quantity of water passing through the treatment process and initiate a signal to actuate a visual alarm when reactivation of water treatment process is required (Figure "A" 1324).
   b. Sense status of security compound access closure and initiate a signal to activate a visual alarm in the security room when the access closure is not secured (Figure "A" 1327).
   c. Detect the return of commercial power after an outage and initiate a signal to actuate an audible alarm in the security room to notify personnel.

2. Sense the fuel level in the gravity storage tank in the LCEB and initiate a signal to the LCC when fuel level falls below a critical point (Figure "A" 1438).

3. Provide a local and general Supervisory Monitoring Subsystem in the LCC to alert and/or aquaint personnel of the status of support equipment and/or systems.

   a. Sense the level of waste in the tunnel junction sewage sump and initiate a signal to the LCC when level exceeds a critical point (Figure "A" 1210).

(Continued)

SHEET 1 OF 5 NOMENCLATURE MONITORING SYSTEM, EQUIPMENT FAULT, LCF FIGURE A NUMBER 1396

2-68340-5

I. A. 3. (Continued)

b. Sense status of LCEB blast door and provide a visible signal in the LCC when door is not properly secured (Figure "A" 5003).
c. Provide a visible reading in the LCC of the voltage on phases A, B and C of the primary power, taken on the line side of both commercial and standby power in the LCEB (Figure "A" 1323).
d. Fire in the LCEB, or a fault in the fire detection loop, shall each give visual and audible alarms in the LCC. Alarm silencing provisions are required (Figure "A" 1328).
e. Detection of a fire in the LCSB or access shaft shall give a visual and audible alarm in the LCC. Alarm silencing provision is required (Figure "A" 1328).

B. Design Constraints

1. Power

Facility power at 120 volts, single phase and 480/277 volts, 3 phase, both 60 cycles.

2. Physical

Not applicable.

3. Interface

a. Sewage Disposal System, LCF (Figure "A" 1210).
b. Electrical System, LCF (Hard) (Figure "A" 1323).
c. Water Supply System, LCF (Figure "A" 1324).
d. Security System, LCF (Figure "A" 1327).
e. Fire Alarm System, LCF (Figure "A" 1328).
f. Shock Attenuation System, LCC (Figure "A" 1241).
g. Fuel System, LCEB (Figure "A" 1438).
h. Electrical System, LCSB (Figure "A" 1437).
j. Blast Door Installation, LCEB (Figure "A" 5003).

4. Environmental

Not applicable.

5. Weapons Effect

Panels and circuitry in hardened facilities shall withstand effects of nuclear shock per D2-30082.

(Continued)

I. A. (Continued)

6. Monitoring

Not applicable.

7. Special Considerations

The following operating control switches shall be mounted on LCC Supervisory Panel:

a. Primary power transfer override (Figure "A" 1323).
b. Control unlocking of door from security room to access shaft (Figure "A" 1327).
c. Control of water and sewage emergency shutoff valves (Figure "A" 1210 and 1324).
d. Valve control for LCC water tank pressurization (Figure "A" 1324).

C. Operability and Maintainability

Monitoring Panels shall have test capability.

D. Reliability

E. Applicable Documents

D2-30082, Facilities Criteria for WS-133B, LCF

II RECOMMENDED SOLUTION

A system will be provided to monitor the operational status of critical LCF equipment. The system will include provisions for audible and/or visible alarms to denote occurrence of faults.

A. Monitoring in the LCSB will be as follows:

1. A Monitor and Alarm Station will be installed in the security room to indicate the status of the security gate (Figure "A" 1327) and to indicate necessity to recycle Water Treatment System (Figure "A" 1324). When the security gate

(Continued)

II. A. 1. (Continued)

is not latched, when the water flow through the Treatment System has reached a predetermined amount, the indicator lamp will be lighted. A push button will also be located on the panel to unlock the security gate.

2. A Commercial Power Supervisory Panel will be installed in the security room to signal the return of commercial power after an outage. The panel will include a buzzer, relay and a reset push button. The relay is deenergized and drops out on loss of power, putting the buzzer in the circuit. The return of commercial power will activate the buzzer until the relay is energized by the reset push button. When the relay is reset, the buzzer is locked out of the circuit.

B. A sensing device will be provided to detect a critical low fuel level in the gravity storage tank (Figure "A" 1438). If fuel reaches critical level, a signal will be sent to the LCC.

C. A sensing device will be provided to detect a critical high sewage level in the tunnel junction sewage sump (Figure "A" 1210). If sewage reaches critical level a signal will be sent to the LCC.

D. A Supervisory Panel will be located in the LCC to indicate malfunctions by lights and/or audible alarms. It will also contain some operating controls.

1. The panel will display the following malfunctions:

a. Critical low level in LCEB gravity storage tank for diesel fuel.
b. Critical high level in sewage sump in tunnel junction.
c. LCEB blast door not properly secured.
d. Fire detected in the LCEB or activation of the tunnel junction manual station will light a display and activate a bell. An ACKNOWLEDGE button will silence the bell but the display will remain lighted until fault is cleared. Similar equipment will indicate a fault in the LCEB fire detection loop by sounding a buzzer.
e. Fire detected in the LCSB or access shaft will light a display and activate a bell. An ACKNOWLEDGE button will silence the bell but the display will remain lighted until fault is cleared.
f. A voltmeter and selector switch will indicate voltage in each phase of power delivered to the line side of the transfer breakers, from both commercial and standby power sources.

(Continued)

II. D. (Continued)

2. The Supervisory Panel will have the following operating controls:

   a. Control of primary power transfer (Figure "A" 1323).
   b. Control of water and sewage emergency shutoff valves (Figures "A" 1210 and 1324).
   c. LCC water tank pressurization valve control switch (Figure "A" 1324).
   d. Soft access security door latch push button (Figure "A" 1327).

E. Major items of equipment include:

1. LCC Supervisory Panel with switches, relays, buzzers, bells, and back-lighted nameplates.

2. LCSB Monitor and Alarm Station with switches and indicating lights.

3. Commercial Power Supervisory Panel with relay and buzzer.

4. Conduit and wire.

NOTE

This Figure "A" is similar to Figure "A" 1396.3 except for new equipment monitoring requirements and deletion of diesel generator unit and environmental control monitoring functions.

TYPE OF LIST: A REAL PROPERTY INSTALLED EQUIPMENT

MODEL DESIGNATION: B SM-80 WEAPON SYSTEM

SUB SYSTEM IDENTIFICATION: C POWER

CONTRACTOR: D THE BOEING COMPANY

FIGURE A NUMBER: E 1405

MILITARY NOMENCLATURE AND FED. MFR'S CODE: F

COMMON NOMENCLATURE: G FUEL SYSTEM, LF

H ORIGINATION DATE: 2-14-63

J AFBSD APP DATE: 4-11-63

CONTRACT NO.: K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	2.57.5.1 2.57.5.2 2.57.5.3 2.57.5.4 2.57.5.5 2.57.5.7 2.57.5.6 2.57.5.8 2.57.5.9 2.57.5.10 2.57.5.11 2.57.5.12

I. TECHNICAL REQUIREMENTS

A requirement exists to supply fuel to operate a standby diesel generator unit in the Launcher Equipment Building. A system shall be provided to fulfill the following requirements:

A. Functional Requirements

1. A means shall be provided for filling the hardened bulk fuel storage tank from a mobile carrier at an accessible Grade Level location. Protection shall be provided to prevent contamination of stored fuel from outside environment.

2. Facilities for hardened fuel storage are required. Fuel storage shall be adequate to provide for the extended survival period plus 10 days, plus 5-percent reserve. The fuel level in the bulk fuel storage facility shall be sensed and transmitted to a liquid level indicating device in the LEB. Low fuel level in the bulk fuel storage facility shall be sensed and an alarm signal sent to Generator Fault Display Panel for transmission to the C-163 Signal Data Converter (Figure "A" 13000), when fuel level reaches the minimum required for the extended survival period plus 10-day reserve.

3. A means is required to transfer fuel from bulk storage to gravity storage in the LEB, with a provision for returning possible overflow. The transfer operation shall be automatically controlled by the liquid level demands of the LEB gravity storage facility. A manual transfer system shall be provided as an emergency measure to replace the normal transfer system during periods of automatic equipment failure.

(Continued)

1. A. (Continued)

4. Storage is required in the LEB to provide gravity feed to the engine of the standby generator set. The storage shall have sufficient capacity to provide a 43-hour supply at full load. The gravity storage facility shall be equipped with a means to sense predetermined normal operating levels and to transmit signals for automatic control of transfer equipment. A low fuel level shall be sensed and an alarm signal sent to Generator Fault Display Panel for transmission to the C-163 Signal Data Converter (Figure "A" 13000) when a minimum 36-hour supply remains. There shall be a local means of indicating the fuel level in gravity storage.

5. A supply of fuel shall be provided by gravity flow from gravity storage to the engine of the standby generator set at full load conditions. Provide for return of excess fuel to gravity storage.

B. Design Constraints

1. Power

120 volts, single phase, 60 cycles.

2. Physical

Not applicable

3. Interface

a. Physical

All system components are mounted on shock attenuation platform in the LEB with the exception of the bulk storage tank and the interconnecting piping and valves which are subject to full dynamic load with movement in both vertical and horizontal directions.

b. Electrical

Fuel Transfer System electrical power and Control System components will interface with Commercial and Standby Power Systems.

(Continued)

I. B. (Continued)

4. <u>Environmental</u>

   a. <u>Ambient</u>

      Maximum temperature 122 deg F.

   b. <u>Dynamic</u>

      The facilities located external to the LEB shall be hardened and provided with flexible connections so that they possess shock resistant characteristics capable of withstanding full dynamic load.

5. <u>Weapons Effects</u>

   The hardened facility shall withstand the weapons effects as specified in D2-30081 Facilities Criteria for WS-133B Launch Facility, Operational, and 62-83-BSD Weapon Effects Criteria.

6. <u>Monitoring</u>

   There shall be monitoring for the critical low levels in the bulk and gravity storage tanks for malfunction indication at the LCC. The signals shall be electrically transmitted.

7. <u>Operating Life</u>

   The LF Fuel System shall have a minimum operating life of 10 years.

8. <u>Safety Considerations</u>

   a. Safety guards shall be provided where exposed rotary drives are encountered.
   b. Tank vents shall terminate in a location where air volume prohibits the formation of an explosive fuel mixture and air velocity is greater than that of flame propagation.

(Continued)

I. B. (Continued)

9. Special Considerations

Not applicable

C. Operability and Maintainability

The hardened bulk storage tank shall be manifolded to the LEB so that fuel can be readily removed from the tank.

D. Reliability

E. Applicable Documents

1. D2-30081 Facilities Criteria for WS-133B Launch Facility, Operational.

2. BSD 62-83 Weapon Effects Criteria.

II. RECOMMENDED SOLUTION

It is recommended that a fuel system be installed for the Launcher Equipment Building to supply fuel to the standby diesel generator. A system will be provided as follows:

A. A hardened cylindrical tank, with hemispherical heads, will be located underground near the LEB. The tank will be provided with a blind flanged combination fill and pumpout line, and pressure vent line terminating 12 inches above Grade. A pressure type liquid level transmitter will be connected by tubing to a liquid level gage in the LEB. The gage will have alarm contacts and be set to sense the low liquid level and signal an alarm to Generator Fault Display Panel for transmission to the C-163 Signal Data Converter. A hydrostatic pressure type liquid level gage with hand pump, wall mounted in the LEB, will provide liquid level indication. The combination fill and pumpout, and pressure vent lines will each have a normally closed manual shutoff valve located in the LEB to preserve the facility hardened condition. The tank vacuum vent line will terminate in the LEB and be provided with a conservation vacuum vent valve. The pressure vent line will be connected to the vacuum vent line in the LEB.

(Continued)

II. (Continued)

B. A rotary, motor driven pump and connecting piping will provide fuel transfer from the bulk storage tank to the gravity storage tank in the LEB. Control circuitry and magnetic starter will operate the pump in accordance with high and low operating gravity storage demands. A hand operated pump with bypass valves and piping will provide fuel transfer during periods of automatic equipment failure. The combination fill and pumpout line will be connected to the suction line. A spool will be removed to allow a portable pump to transfer the bulk storage tank fuel to a mobile tanker at Grade. A combination vent and overflow pipe between the gravity tank and bulk storage tank will be connected to the pressure and vacuum vent line in the LEB and shall provide for return of excess fuel.

C. A vertically mounted gravity storage tank located adjacent to the standby diesel generator shall be installed so that sufficient clearance exists between top of tank and ceiling for piping and control equipment. A displacement type liquid level switch with high and low level pump control and low level alarm electrical contacts shall control the operation of the transfer pump system. The displacers will be preset for normal operating levels and for a critical low level. The critical low level contacts shall monitor low liquid level in the gravity storage tank and signal an alarm to the Generator Fault Display Panel for transmission to the C-163 Signal Data Converter. The gravity tank will be provided with a laminated flat liquid level gage glass with shutoff valves. The tank will be provided with a manual drain valve. The fuel in the gravity storage tank shall be capable of being transferred into the bulk storage tank for maintenance purposes. A hose will be connected between the gravity tank drain and the suction of the rotary motor driven pump. A bypass connection between the pump discharge and the gravity tank overflow line will return the fuel to bulk storage. Piping shall provide fuel flow between the gravity storage tank and the engine fuel pump of standby diesel generator and provide for return of excess fuel to the gravity tank.

D. The system will contain the following equipment:

1. Bulk storage tank.
2. Combination fill and pumpout line with flanged cover.
3. Pressure vent line with flanged cover.
4. Liquid level indicator, hydrostatic bubbler type, with hand pump.
5. Liquid level transmitter, gage, and tubing.
6. Vacuum vent valve.
7. Piping and valves.

(Continued)

II. D. (Continued)

8. Rotary positive displacement pump, motor driven, 120 volts, single phase, 60 cycles.

9. Hand operated pump.

10. Gravity storage tank.

11. Displacement type liquid level switch.

12. Strainers.

13. Gage glass with shutoff valves.

NOTE

This Figure "A" is similar to Figure "A" 1405.3, except for changes required to meet new WS-133B Weapons Effects Criteria.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C MONITORING	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	J AFBSD APP DATE	CONTRACT NO.
E 1415	F	G FIXTURE, EMERGENCY LIGHTING & ALARM, BATTERY OPERATED, LCSB	2-14-63	4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	B FUNCTIONAL CLASS INDEX	M STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63						1					3						RPIE			W-6	2.37.7

I. TECHNICAL REQUIREMENTS

A requirement exists to provide emergency illumination and an audible alarm in the LCSB security room in event of primary power failure. An emergency lighting and alarm device shall be provided as follows:

A. Functional Requirements

1. The device shall be completely self-contained, battery operated, suitable for shelf mounting.
2. The device shall be equipped with a single floodlight assembly.
3. A battery charger shall be incorporated to automatically maintain the battery in a fully charged condition.
4. The floodlight shall come on automatically and an audible alarm shall sound in event of a primary power failure. A means of silencing the audible alarm, without affecting the light, shall be incorporated. An indicator light shall come on when the alarm has been silenced.
5. Indicators and controls shall be provided to monitor, test and control the device.
6. The device shall connect to a standard 120-volt, single-phase grounded-pole receptacle conveniently located for this purpose.
7. The device shall deactivate automatically upon return of primary power.

II. RECOMMENDED SOLUTION

A. A battery operated emergency lighting and alarm fixture will be provided as follows:

1. The battery operated unit will be completely self-contained and designed for shelf mounting. The battery will be 6-volt, with 30 ampere-hour capacity, and set in a heat-resistant, plastic case.

2. A 25-watt, 6-volt, sealed-beam floodlamp will be furnished with adjustable beam direction.

3. A full-wave selenium rectifier battery charger will be incorporated with provisions for manually controlled two-rate charging. High rate charging will restore the battery capacity within 12 hours, after 1-1/2 hours use of the light. Low rate charging will be a trickle charge for maintaining the battery in a fully charged condition.

4. A relay will be incorporated which will sense the loss of primary power and activate the audible alarm and light the floodlamp. This relay will also detect the return of primary power and deactivate the unit.

5. A panel will be mounted on the front of the unit on which the following equipment will be mounted:

   a. Charge toggle switch to set rate of charge.
   b. Pilot light to indicate switch is set on "high" rate of charge.
   c. Disconnect switch for floodlamp.
   d. Pilot light to indicate unit is connected to primary power and is operable.
   e. Test switch to simulate primary power failure.
   f. Buzzer for audible alarm.
   g. Buzzer silencing switch.
   h. Pilot light to indicate buzzer has been silenced.

6. A 6-foot, 3-wire extension cord will be provided, with matching plug for connection to single-phase, grounded receptacle provide for this unit.

7. Power requirements are 120 volts, single phase, 60 cycles.

NOTE

This Figure "A" is identical to Figure "A" 1415.

TYPE OF LIST
A REAL PROPERTY INSTALLED EQUIPMENT

MODEL DESIGNATION: B SM-80 WEAPON SYSTEM
SUB SYSTEM IDENTIFICATION: C ENVIRONMENT
CONTRACTOR: D THE BOEING COMPANY

FIGURE A NUMBER: E 1436
MILITARY NOMENCLATURE AND FED. MFR'S CODE: F
COMMON NOMENCLATURE: G VENTILATION SYSTEM, LCEB
H ORIGINATION DATE: 2-14-63
J AFBSD APP DATE: 5-6-63
CONTRACT NO: K AF 04(694)-266

L REVISIONS: Revision Date 1	Code 2	Initiated By 3	AFBSD Approval Date 4	M Functional Class Index	N Stock Number: Fed. Supply Class 1	Federal Item ID Number 2	Manufacturer's Part Number 3	P LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q Total on Order	R Estimated Unit Price	S Estimated Total Price	T Cogn. Lab Center & Service	U Proposed Source of Supply	V Source Code	W Est. Prod. Lead Time	X End Item Effectivity	Y Remarks
2-22-63	6/	STL Review	5-6-63						1					3						RPIE			W-6	

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide air intake and exhaust plenums to supply fresh outside air to meet the requirements of the Environmental Control System (Figure "A"). The lower ends of the plenums shall be sized to accommodate blast-induced debris in the amounts anticipated, without restricting airflow. A means is required to delay blast pressure transmission to the LCEB to permit full closure of the blast valves. 2.53.4

B. Design Constraints

1. Power

Not applicable.

2. Physical

Not applicable.

3. Interface

The intake and exhaust plenums shall interface with the LCEB structure, the Environmental Control System (Figure "A") and the Security System, LCF (Figure "A" 1327).

(Continued)

I. B. (Continued)

4. Environment

a. Ambient

Refer to AF/BSD Exhibit 62-80.

b. Dynamic

Refer to D2-30082.

5. Weapons Effects

Refer to D2-30082.

6. Monitoring

The position of the plenum gratings shall be monitored.

7. Operating Life

The system shall be designed for an operating life of 10 years.

8. Safety Considerations

Refer to AF/BSD Exhibit 62-79.

9. Special Considerations

Not applicable.

C. Operability and Maintainability

Ladders are required in the intake and exhaust plenums to facilitate periodic cleanout.

D. Reliability

(Continued)

I. (Continued)

E. Applicable Documents

1. AF/BSD Exhibit 62-80 Design Criteria for WS-133B, Environmental Control Systems.

2. D2-30082, Facilities Criteria for WS-133B LCF, Operational.

3. AF/BSD Exhibit 62-79 Life Support Criteria.

II. RECOMMENDED SOLUTION

Structural plenums will be provided to supply and exhaust air between the LCEB and Grade Level. The plenums will be provided with gratings, at Grade Level, which will be furnished with locking devices. A suitably sized debris pit will be provided at the lower end of each plenum and a structurally embedded ladder will be provided, from Grade, to permit periodic cleanout. A pressure delay route will be provided in the design of the air path to permit full closure of the blast valves before overpressure reaches the LCEB. The delay path will be pitched to permit drainage into the debris pit.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C POWER	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 1437	F	G ELECTRICAL SYSTEM, LCSB	2-14-63	K AF 04(694)-266
			J AFBSD APP DATE 5-8-63	

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	B FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	5-8-63																					

I. TECHNICAL REQUIREMENTS

A requirement exists for a supply of alternating-current electric power to be furnished to the LCSB for the soft and hardened LCF.

A. Functional Requirements

1. Commercial power shall be supplied at 480 (±5 percent) volts, 3 phase, 60 (±1-1/2 percent) cycles, 3 wire, delta connected, with not more than 5-percent rms harmonics. Power feeders shall be protected against the effects of overloads. Commercial power shall be supplied from main power feeder to the hardened facility which will pass through the LCSB.

2. A skid-mounted engine driven generator set is required to provide standby power in event of commercial power failure. The engine generator shall be sized to adequately provide power to those electrical circuits necessary to perform essential functions. Power shall be supplied at 480 volts, 60 cycles, 3 phase, 4 wire, wye-connected, with the same tolerances specified for the commercial power. The generator set and its auxiliaries shall be devoid of radio interference generating capability as defined in Document D2-30025.

The engine generator shall have all the necessary controls for manually starting and stopping, shall have the capability of continuous unattended operation for a period of 10 days, including sufficient fuel, lubricating oil and filter capacity. The following controls, equipment and monitoring is required:

a. A means of sensing and automatic shutdown shall be provided if the following conditions occur:

(1) Engine overspeed
(2) Low lubricating oil pressure

REMARKS:
2.52.51
2.52.52
2.52.53
2.52.54
2.52.55
2.52.56
2.52.57
2.52.58
2.52.59
2.52.60
2.52.61
2.52.62
2.52.63
2.52.64
2.52.65
2.52.66
2.52.67
2.52.68
2.52.69
2.52.70
2.52.71
2.52.72
2.52.73
2.52.74
2.52.75
2.52.76
2.52.77
2.52.78
2.52.79

I. A. (Continued)

b. Display lights in the generator room to indicate which of the above controls have operated 2.52.80
c. Control panels for both engine and generator with necessary instruments and controls to perform the following: 2.52.81

(1) A means of starting engine 2.52.82
(2) Control engine speed 2.52.83
(3) Indicate jacket water temperature 2.52.84
(4) Indicate hours of engine operation 2.52.85
(5) Indicate frequency 2.52.86
(6) Indicate voltage on all phases 2.53.3.2
(7) Indicate amperes on all phases 2.53.3.29
(8) Adjust voltage
(9) Indicate oil pressure and temperature
(10) Indicate exciter d-c voltage
(11) Regulate generator voltage
(12) Govern engine speed
(13) Shut down engine and lockout

d. A standby Power Control Panel is required in the security room for remote control of the generator set. The following controls and indicators shall be provided:

(1) Engine start switch.
(2) Engine jacket water over-temperature alarm, alarm shutoff and reset button.
(3) Wattmeter
(4) Voltmeter on all phases
(5) Frequency meter
(6) Lockout stop button
(7) Engine speed adjusting governor control switch
(8) Engine overspeed or low lubricating oil pressure shutdown switch
(9) Voltage output regulator

e. Fuel is required for operation of the standby power unit (Figure "A" 1230).
f. The engine accessories shall include the following:

(1) A means shall be provided to remove water and sludge from fuel before distribution to engine fuel system
(2) Electric starter system
(3) A means for keeping the starter battery at full charge
(4) A means for reducing exhaust noise

(Continued)

I. A. 2 (Continued)

(5) A means of filtering engine lubricating oil
(6) A means of preventing oil from dripping on floor
(7) A means of cooling engine lubricating oil
(8) Engine cooling capability to withstand continuous operation when the operating temperature ranges from 40 to 120 deg F
(9) A means of keeping a positive head of fuel on engine fuel system at all times
(10) A means of dampening engine vibration to prevent wear or damage to engine-mounted accessories.
(11) A means of providing full pressure engine lubrication
(12) A means of removing harmful dust and grit from engine intake air

3. A means shall be provided to manually transfer the essential loads from the commercial power source to the standby source, so interlocked to prevent accidental paralleling. This means shall also provide overload protection for the commercial power feeders and the standby power unit and feeders.

4. A distribution system shall be supplied for the LCSB with circuit protection for both main and distributing circuits. General distribution shall be made to all loads in the LCSB and surrounding area. Power circuits shall be kept a minimum of 24 inches from communications or signal circuits where possible. Power of 480 volts, 3 phase, 60 cycles shall be transformed to 120/208-volt, 3-phase, 60-cycle, 4-wire power for those loads requiring the lower voltages.

a. Power shall be distributed to the following loads that shall be considered nonessential to site operation, security or personnel livelihood:

(1) 480-volt, 3-phase, 60-cycle power to the Commercial Power Supervisory Panel (Figure "A" 1396)
(2) 120/208-volt, 3-phase, 60-cycle power to special receptacles on external wall of LCSB and in parking area for following vehicles:

(a) Service vans
(b) Electronic maintenance van (Figure "A" 4063)
(c) Mechanical maintenance van (Figure "A" 4031)
(d) Transporter-erector semitrailer (Figure "A" 4059)

(Continued)

I. A. 4 (Continued)

Each location shall have the following receptacles:

(a) One Pyle-National 120/208-volt, 3-phase, 60-cycle, 5-wire, 5-pole, 30-ampere, weatherproof No. ZZM-WF-17116-16S, to match plug on vehicle
(b) One Pyle-National 120/208-volt, 3-phase, 60-cycle, 5-wire, 5-pole, 60-ampere, weatherproof No. ZZM-WF-17120-37S, to match plug on vehicle

(3) 208-volt, 3-phase, 60-cycle power for kitchen ventilation (Figure "A" 1390)
(4) 120-volt, single-phase, 60-cycle power for nonessential lighting
(5) 120-volt, single-phase, 60-cycle power for receptacles in living areas
(6) 120/208-volt, single-phase, 60-cycle, 3-wire power for operating kitchen equipment
(7) 120/208-volt, 3-phase, 60-cycle, 4-wire power for operating laundry equipment
(8) 120-volt, single-phase, 60-cycle power for diesel engine water jacket heater
(9) 480-volt, 3-phase, 60-cycle power for electric room heater in generator room
(10) 480-volt, 3-phase, 60-cycle power for heating water for kitchen laundry and personnel
(11) A minimum of 10-percent spare circuits for possible future loads

b. Power shall be distributed to the following loads considered essential to LCSB operation and security:

(1) 480-volt, 3-phase, 60-cycle, 3-wire power for the service elevator (Figure "A" 1242)
(2) 120-volt, single-phase, 60-cycle power for Security System, LCF (Figure "A" 1327)
(3) 120-volt, single-phase, 60-cycle power for Monitoring System (Figure "A" 1396)
(4) 120-volt, single-phase, 60-cycle power for LCSB Ventilating System (Figure "A" 1390)
(5) 480-volt, 3-phase, 60-cycle, 3-wire power for the Water Supply System (Figure "A" 1324)
(6) 120-volt, single-phase, 60-cycle power for MCN telephone equipment
(7) 120-volt, single-phase, 60-cycle power for VHF tranceiver and radio
(8) 120-volt, single-phase, 60-cycle power for vehicle headbolt heaters
(9) 120-volt, single-phase, 60-cycle power for essential lighting
(10) 120-volt, single-phase, 60-cycle power for receptacles in essential areas
(11) 120-volt, single-phase, 60-cycle power for cable fault locator operation (Figure "A" 1281)
(12) 480-volt, 3-phase, 60-cycle power for hot water circulation (Figure "A" 1325)
(13) 120-volt, single-phase, 60-cycle power for boiler operation (Figure "A" 1325)
(14) A minimum of 10-percent spare circuits for possible future loads
(15) 480-volt, single-phase, 60-cycle power to the LCSB Fire Alarm System (Figure "A" 1328)
(16) 120-volt, single-phase, 60-cycle power for emergency light receptacle located on upper wall of LCSB security room (Figure "A" 1415)

(Continued)

I. A. 4 (Continued)

(17) 480-volt, 3-phase, 60-cycle power for elevator shaft sump pump (Figure "A" 1210)
(18) 480-volt, 3-phase, 60-cycle power for operation of brine pump (Figure "A")
(19) 480-volt, 3-phase, 60-cycle power for operation of brine-to-air heat exchanger fan (Figure "A")
(20) 480-volt, 3-phase, 60-cycle power for electric room heater in the Environmental System equipment room (Figure "A" 1325)
(21) 480-volt, 3-phase, 60-cycle power for heater in garage
(22) 120-volt, single phase, 60-cycle power for engine starter battery charger.

c. The primary power neutral shall be carried insulated throughout the soft facilities. It shall be connected to the structures and equipment bus in the LCSB, leads to, and is connected to the LCEB equipment bus which in turn connects to the LCCGP in the LCC (Figure "A" 1323).

Provide instrument grounding tie points and equipment ground tie point in LCSB and connect to the LCCGP. Refer to Figure "A" 1323 for facility grounding requirements.

B. Design Constraints

1. Power

Not applicable

2. Physical

Not applicable

3. Interface

a. Electrical System, LCF (Hard) (Figure "A" 1323)
b. Instrument, equipment and power neutral grounding shall be accomplished in accordance with Figure "A" 1323

4. Environmental

Equipment shall be operable in a natural environment of -40 to 120 deg F.

(Continued)

I. B. (Continued)

5. Weapons Effects

Not applicable

6. Monitoring

Both the loss and return of commercial power shall be monitored (Figure "A" 1396). Standby power unit shall be monitored.

7. Operating Life

Equipment shall operate a minimum of 10 years with normal maintenance.

8. Safety Considerations

All high voltage (480) equipment shall be distinctly marked to prevent injury due to improper usage.

9. Special Considerations

All receptacles and convenience outlets shall be located for maximum accessibility.

C. Operability and Maintainability

Standby generator set shall be remotely controlled from the LCSB security room.

D. Reliability

E. Applicable Documents

1. D2-30082, WS-133B Launch Control Facility Facilities Criteria.
2. D2-6952, Volume II, S133-11-0-3 WS-133A OGE Figure "A's"

(Continued)

I. E. (Continued)

3. BSD Exhibit 62-77 Electric Power and Cabling Subsystem Design Criteria for WS-133B (Minuteman)

4. BSD 62-82 Safety Criteria Document

II. RECOMMENDED SOLUTION

Electrical power will normally be provided the LCSB from a commercial source at 480 volts, 3 phase, 60 cycles, 3 wire, delta-connected secondary, with a maximum of 5-percent rms harmonics.

A. Commercial power will be supplied from the main power feeders to the hardened facility and will be connected to the line side of the commercial power main circuit breaker in the LCSB security room.

B. A diesel engine generator set will be provided to furnish standby power for the LCSB. Standby power feeders will be connected to the line side of the standby power main circuit breaker in the security room.

The generator set will be directlyconnected and devoid of radio interference generating capability as defined in D2-30025. The generator set will operate at either 1200 or 1800 rpm, will be vibration dampener mounted on a steel skid type base with drip pan attached and will provide 480-volt, 3-phase 4-wire, 60-cycle power. The generator set will be free of rms harmonics within 5-percent. The auxiliaries of the engine generator will include the following:

1. Governor system capable of maintaining frequency within 1-1/2 percent.

    a. A means of adjusting engine speed by a governor control switch will be provided.

2. An electric engine starting system will be provided.

3. A voltage regulator will be provided to maintain voltage within tolerance.

4. A day tank will be provided to gravity feed the engine fuel injection pumps.

(Continued)

II. B (Continued)

5. Engine cooling will be accomplished by use of radiator and engine driven fan. Radiator and fan will be attached to engine bed frame.

6. An overspeed governor with shutdown system will be installed to prevent engine overspeed.

7. Engine driven fuel supply pump will be provided to lift fuel from storage tank to engine service tank.

8. An illuminated Generator Control Panel will be provided in the generator room. Panel will be provided with the following instruments and controls:

   a. Oil pressure gage
   b. Water temperature gage
   c. Fuel oil pressure gage
   d. Throttle with micro adjustment
   e. Engine start switch
   f. Emergency stop button with lockout feature
   g. Generator voltage regulator
   h. Engine operating hour meter
   j. Engine governor speed control switch
   k. Voltmeter indicating a-c voltage on all phases
   m. Ammeter indicating amperes on all phases
   n. Wattmeter
   p. D-c voltmeter
   q. Fault shutdown indicators

9. A remote illuminated indicating control panel will be provided in the security room. Controls and instruments provided will include the following:

   a. Engine start switch
   b. Emergency stop button with lockout control
   c. Engine governor speed control switch
   d. Voltmeters indicating voltage on all phases
   e. Generator voltage regulator
   f. Frequency meter
   g. Wattmeter
   h. Alarm, alarm stop and alarm reset button for high jacket water temperature alarm system
   j. Indicators to annunciate cause of engine fault shutdown

(Continued)

II. B (Continued)

10. A damper will be provided for the radiator and an immersion heater will be provided for heating water jacket. Damper and heater will be thermostatically controlled.

11. A heavy duty exhaust silencer with flexible couplings will be provided.

12. Major items of equipment are:

    a. Diesel generator set complete with panels for control and instrumentation
    b. Starting motor
    c. Starting batteries with trickle charger
    d. Mechanically interlocked manually operated circuit breakers

C. The main circuit breaker for the LCSB commercial power and the circuit breaker for the standby power will be mechanically interlocked to prevent accidental paralleling of the circuits. Load transfer will be manual. These two main circuit breakers will also protect their respective feeders against excessive overloads.

D. A distribution system will be installed in the LCSB with circuit breaker protection for all distributing circuits. There will be two main divisions of the system as follows:

1. A system for loads that are essential to the operation and security of the site and to the livelihood of the personnel. This system will be connected to the terminal cabinet for the standby power unit. Power will be distributed as specified in technical requirements. Power lines will be kept a minimum of 24 inches from signal and communications circuits where possible.

2. A system for nonessential loads, which is not connected to the standby power source. Power will be distributed as specified in technical requirements.

E. The primary power neutral will be carried insulated throughout the soft facilities. It will be connected to the structures and equipment bus in the LCSB and will lead to and be connected to the LCEB equipment bus, which in turn, will connect to the LaunchControl Center ground tie point. This will be the only ground connection for the primary power neutral in both the hard and soft facilities.

Two instrument grounding tie points and one equipment grounding tie point will be provided in the Support Building at convenient locations. These tie points will be connected to the LCCGP in the LCC.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C POWER	D THE BOEING COMPANY

FIGURE & NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 1438	F	G FUEL SYSTEM, LCEB	2-14-63	K AF 04(694)-266
			J AFBSD APP DATE 5-8-63	

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
~~2-22-63~~	6A	STL Review	5-8-63						1					3						RPIE			W-6	2.52.96.1 2.52.96.2 2.52.96.3 2.52.96.4 2.52.96.5 2.52.96.6 2.52.96.7 2.52.96.8 2.52.96.9 2.52.96.10

I. TECHNICAL REQUIREMENTS

A requirement exists to supply fuel to operate a Standby Diesel Generator Unit in the Launch Control Equipment Building. A system shall be provided to fulfill the following requirements:

A. Functional Requirements

1. A means shall be provided for filling the hardened bulk fuel storage tank from a mobile carrier at an accessible grade level location. Protection shall be provided to prevent contamination of stored fuel from outside environments.

2. Facilities for hardened fuel storage are required. Fuel storage shall be adequate to provide for the extended survival period plus 10 days, plus 5-percent reserve. The fuel level in the bulk fuel storage facility shall be periodically checked by means of a manually operated sensing device with an indicator located in the LCEB.

3. A means is required to transfer fuel from bulk storage to gravity storage in the LCEB, with a provision for returning possible overflow. The transfer operation shall be automatically controlled by the liquid level demands of the LCEB gravity storage facility. A manual transfer system shall be provided as an emergency measure to replace the normal transfer system during periods of normal system failure.

(Continued)

I. A. (Continued)

4. Storage is required in the LCEB to provide gravity feed to the engine of the standby generator set. The storage shall have sufficient capacity to provide a 12 - hour supply. The gravity storage facility shall be equipped with a means to sense predetermined normal operating levels and to transmit signals for automatic control of transfer equipment. A low fuel level shall be sensed and an alarm signal sent for monitoring (Figure "A" 1396) when a 6 - hour supply remains. There shall be a local means of indicating the fuel level in gravity storage.

5. A supply of fuel shall be provided by gravity flow from gravity storage to the engine of the standby generator set at full load conditions and provide for return of excess fuel to gravity storage.

B. Design Constraints

1. Power

Equipment shall operate on facility power.

2. Physical

Not applicable

3. Interface

a. Environmental Control System, LCF.
b. Shock Attenuation, LCEB, Figure "A" 1439.

4. Environmental

a. Ambient

Maximum temperature 122 deg F.

b. Dynamic

The facilities located external to the LCEB shall be hardened and provided with flexible connections so that they possess shock resistant characteristics capable of withstanding full dynamic loads.

(Continued)

I. B. (Continued)

5. Weapon Effects

The hardened facility shall withstand the weapons effects as specified in D2-30082 Facilities Criteria for WS-133B Launch Control Facility, Operational.

6. Monitoring

Gravity storage low level will be electrically transmitted for monitoring.

7. Operating Life

The LCF Fuel System shall have a minimum operating life of ten years.

8. Safety Considerations

a. Safety guards shall be provided where exposed rotary drives are encountered
b. Tank vents shall terminate in a location where air volume prohibits the formation of an explosive fuel mixture and air velocity is greater than that of flame propagation

9. Special Considerations

Not applicable

C. Operability and Maintainability

The hardened bulk storage tank shall be manifolded to the LCEB so that fuel can be readily removed from the tank.

D. Reliability

(Continued)

I. (Continued)

E. Applicable Documents

1. D2-30082 Facilities Criteria for WS-133B Launch Control Facility, Operational.

2. BSD/STL 61-99 Human Engineering.

3. BSD 62-83 Weapon Effects Criteria.

II. RECOMMENDED SOLUTION

It is recommended that a fuel system be installed for the Launch Control Equipment Building to supply fuel to the standby diesel generator. A system will be provided as follows:

A. A hardened cylindrical tank, with hemispherical heads, will be located underground near the LCEB. The tank will be provided with a blind flanged combination fill and pump out line, and pressure vent line terminating 12-inches above grade. A hydrostatic pressure type liquid level gage with hand pump, wall mounted in the LCEB, will provide liquid level indication. The combination fill and pump out, and pressure vent lines will each have a normally closed manual shut-off valve located in the LCEB to preserve the storage facility hardened condition. The tank vacuum vent line will terminate in the LCEB and be provided with a conservation vacuum vent valve. The pressure vent line will be connected to the vacuum vent line in the LCEB.

B. A rotary motor-driven pump and connecting piping will provide fuel transfer from the bulk storage tank to the gravity storage tank in the LCEB. Control circuitry and magnetic starter will operate the pump in accordance with high and low operating gravity storage demands. A hand operated pump with bypass valves and piping will provide fuel transfer during periods of automatic equipment failure. The combination fill and pump out line will be connected to the suction line. A spool will be removed to allow a portable pump to transfer the bulk storage tank fuel to a mobile tanker at grade. A combination vent and over flow pipe between the gravity tank and bulk storage tank will be connected to the pressure and vacuum vent line in the LCEB and shall provide for return of the excess fuel.

(Continued)

II. (Continued)

C. A vertically mounted gravity storage tank located adjacent to the Standby Diesel Generator shall be installed so that sufficient clearance exists between top of tank and hardened structure for piping and control equipment. A displacement type liquid level switch with high and low level pump control and low level alarm electrical contacts shall control the operation of the transfer pump system. The displacers will be preset for normal operating levels and for a critical low level. The critical low level contacts shall monitor low liquid level in the gravity storage tank. The gravity tank will be provided with a laminated flat liquid level gage glass with shutoff valves. The tank will be provided with a manual drain valve. The fuel in the gravity storage tank shall be capable of being transferred into the bulk storage tank for maintenance purposes. A hose will be connected between the gravity tank drain and the suction of the rotary motor driven pump. A bypass connection between the pump discharge and the gravity tank overflow line will return the fuel to bulk storage. Piping shall provide fuel flow between the gravity storage tank and the engine fuel pump of standby diesel generator and provide for return of excess fuel to the gravity tank.

D. The system will contain the following equipment:

1. Bulk storage tank.
2. Combination fill and pumpout line with flanged cover.
3. Pressure vent line with flanged cover.
4. Liquid level indicator, hydrostatic bubbler type, with hand pump.
5. Vacuum vent valve.
6. Piping and valves.
7. Rotary positive displacement pump, motor driven, 120 volts, single phase, 60 cycles.
8. Hand operated pump.
9. Gravity storage tank.

(Continued)

II. D. (Continued)

10. Displacement type liquid level switch.

11. Strainers.

12. Gage glass with shutoff valves.

NOTE

This Figure "A" is similar to Figure "A" 1438.3 except for changes to meet the new WS-133B Weapons Effects Criteria and the increased fuel requirements.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENTAL	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE / AFBSD APP DATE	CONTRACT NO.
E 1439	F	G SHOCK ATTENUATION SYSTEM, LCEB	H 2-14-63 / J 4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE	CODE	INITIATED BY	AFBSD APPROVAL DATE	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS	FEDERAL ITEM ID NUMBER	MANUFACTURER'S PART NUMBER	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP	LCF	MLCC	SMSB	SRA	MAMS	VAFB	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63						1					3						RPIE			W-6	2.53.2.12 2.53.2.16 2.53.2.17 2.53.2.18 2.53.2.19

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide an isolated structure for mounting shock sensitive equipment in the LCEB, including special shock mounted assemblies and flexible interconnections.

B. Design Constraints

1. Power

Not applicable.

2. Physical

a. A structural steel, shock-isolated platform is required to provide shock protection for shock-sensitive weapon system equipment. The platform will be sized to accommodate mounting provisions and space for the following:

(1) Diesel generator.
(2) Diesel generator enclosure.
(3) Battery.
(4) Day tank (200-gallon).
(5) Fuel transfer pump.
(6) Fuel standby pump.
(7) Steam separator.
(8) Diesel generator jacket water pump.

(Continued)

I. B. 2. a. (Continued)

(9) Oil tank (100-gallon).
(10) Oil filter.
(11) Chiller package.
(12) Expansion tank.
(13) Supply fan.
(14) Exhaust fan.
(15) Hydraulics (blast valves).
(16) Cable pressurisation unit.
(17) Air compressor.
(18) CBR filter.
(19) CBR filter and fan.
(20) Electrical Panels.
(21) Heating and Ventilation Panels.
(22) Heating and ventilation ducts.
(23) Heating and ventilation plenum.
(24) Flexible duct.
(25) Piping and flexible hoses.
(26) Electrical cables.
(27) Shock isolators.
(28) Air bottles.
(29) Platform.
(30) Support attachments for shock isolator (Figure "A" 5007).
(31) Access for maintenance and MGE to equipment mounted on isolated platform structure and adjacent fixed structures.
(32) See D2-30082.

b. Flexible interconnections for all system interconnections between rigid mounted equipment/junctions and isolated platform structure. They will be sufficiently flexible to introduce no significant restraint to the motion of the platform. Connections are required for the following:

(1) Environmental control ducting.
(2) Electrical distribution conduits.
(3) Fluid transmission piping.
(4) Communication cables.

(Continued)

I. B. 2. (Continued)

e. The following miscellaneous items attached to the hardened structure require special shock mounting assemblies:

(1) Lighting fixtures.
(2) Hardened electrical conduits.

3. <u>Interface</u>

The Shock Attenuation System will interface with the following:

a. LCEB hardened structure.
b. Weapon system equipment.
c. Shock isolators (Figure "A" 5007).
d. Pressurized cable system.
e. LCF grounding system (see D2-30082).

4. <u>Environmental</u>

a. <u>Ambient</u>

The Shock Attenuation System will resist all degrading effects of ambient conditions (see D2-30082).

b. <u>Dynamic</u>

The Shock Attenuation System will withstand without damage, the maximum ground shock motions arising from specified Weapons Effects Criteria (see D2-30082).

5. <u>Weapons Effects</u>

For ground shock see Response Spectra D2-30082.

6. <u>Monitoring</u>

Not applicable

(Continued)

I. B. (Continued)

7. <u>Operating Life</u>

See D2-30082.

8. <u>Safety Considerations</u>

Not applicable

9. <u>Special Considerations</u>

For finishes, see D2-30082.

C. <u>Operability and Maintainability</u>

See D2-30082.

D. <u>Reliability</u>

E. <u>Applicable Documents</u>

D2-30082 Facilities Criteria for WS-133B Launch Control Facility, Operational.

II. RECOMMENDED SOLUTION

It is recommended that a system be provided to protect the weapon system equipment in the LCEB from intolerable forces resulting from ground shock. The integrated system will provide protection as follows:

A. A shock attenuated platform will be suspended in the LCEB, in plane with the access floor level. Platform will include space for equipment, maintenance and MGE, as follows:

(Continued)

II. A. (Continued)

1. A structural platform with allowance for vertical and horizontal rattle space and hinged bridge plates for access and to provide floor continuity. Mounting brackets will be attached to the hardened wall and on the attenuated platform. Wall brackets will include provision for vertical travel of platform to the limits of vertical isolators. The platform brackets will also complement this function. All brackets to be compatible with shock isolator (Figure "A" 5007).

B. All lighting fixtures, not attached to shock-isolated platform, will be provided with tension spring hangers.

C. All system interconnections will be flexible to shock-isolated equipment/components as follows:

1. All interconnections of hard-mounted environmental ductwork and shock isolated equipment will be flexible duct/connector type.

2. All interconnection of hard-mounted electrical transmission media and shock-isolated Equipment/Electrical Panels will be flexible conduit type.

3. All interconnection of hard-mounted fluid transmission media and shock-isolated equipment will be flexible hose type.

D. The Shock Attenuation System will consist of the following equipment:

1. Structural mounting platform.

2. Wall brackets.

3. Shock mounting for hard-mounted lighting fixtures.

4. Flexible ducts and connections.

5. Flexible conduit and connections.

6. Flexible hose and connections.

NOTE

This Figure "A" is similar to Figure "A" 1439.3 except for changes required to meet the new weapons effect criteria, and deletion of sway dampers and isolators.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	ORIGINATION DATE / AFBSD APP DATE	CONTRACT NO.
E 1441	F	G SHOCK ATTENUATION SYSTEM, LEB	H 2-14-63 / J 4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	2.58.3.5 2.58.3.6 2.58.3.7 2.58.3.8

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to provide an isolated structure for mounting shock sensitive equipment in the LEB, including special shock-mounted assemblies and flexible interconnections.

B. Design Constraints

1. Power

Not applicable.

2. Physical

a. A structural steel, shock-isolated platform is required to provide shock protection for shock-sensitive weapon system equipment. The platform will be sized to accommodate mounting provisions and space for the following:

(1) Diesel generator.
(2) Battery.
(3) Day tank (150-gallon).
(4) Fuel pump (including stand by).
(5) Oil tank (85-gallon).
(6) Oil filter.
(7) Chiller package.
(8) Expansion tank.

(Continued)

SHEET 1 OF 5 NOMENCLATURE SHOCK ATTENUATION SYSTEM, LEB FIGURE A NUMBER 1441

2-6834-0-5

I. B. 2. a. (Continued)

(9) Supply fan.
(10) Exhaust fan.
(11) Hydraulic (blast valves).
(12) Hydraulic (hatch).
(13) Cable pressurization.
(14) Air compressor.
(15) CBR filter (relief).
(16) CBR and fan (supply).
(17) Electrical Panels.
(18) Heating and Ventilation Panel.
(19) Heating and Ventilation duct and plenum.
(20) Flexible ducts.
(21) Piping and hoses.
(22) Electrical cable.
(23) Shock isolators.
(24) Platform.
(25) Support attachments for shock isolators (Figure "A" 5008).
(26) Access for maintenance and MGE to equipment mounted on isolated platform structure and adjacent fixed structures.
(27) See D2-30081.

b. Flexible interconnections for all system interconnections between rigid mounted equipment/junctions and isolated platform structure. They will be sufficiently flexible to introduce no significant restraint to the motion of the platform. Connections are required for the following:

(1) Environmental control ducting.
(2) Electrical distribution conduits.
(3) Fluid transmission piping.
(4) Communication cables.

c. The following miscellaneous items attached to the hardened structure require special shock mounting assemblies:

(1) Lighting fixtures.
(2) Hardened electrical conduits.

(Continued)

I.B. (Continued)

3. Interface

The shock Attenuation System will interface with the following:

a. LEB hardened structure.
b. Weapon system equipment.
c. Pressurized cable system.
d. LF grounding system (see D2-30081).
e. Shock isolators (Figure "A" 5008).
f. Personnel access shaft actuating mechanism.

4. Environmental

a. Ambient

The Shock Attenuation System will resist all degrading effects of climatic conditions (see D2-30081).

b. Dynamic

The Shock Attenuation System will withstand without damage, the maximum ground shock motions arising from specified Weapons Effects Criteria (see D2-30081).

5. Weapons Effects

Ground shock (see Response Spectra D2-30081).

6. Monitoring

Not applicable.

7. Operating Life

See D2-30081.

8. Safety Considerations

Not applicable.

(Continued)

I. B. (Continued)

9. Special Considerations

For finishes, see D2-30081.

C. Operability and Maintainability

See D2-30081.

D. Reliability

E. Applicable Documents

D2-30081 Facilities Criteria for WS-133B Launch Control Facility, Operational.

II. RECOMMENDED SOLUTION

It is recommended that a system be provided to protect the weapon system equipment in the LEB from intolerable forces resulting from ground shock. The integrated system will provide protection as follows:

A. A shock attenuated platform will be suspended in the LEB, in plane with the access floor level. Platform will include space for equipment as specified in IB2a, maintenance access and MGE. Bridge plates will provide access and floor continuity. Mounting brackets on structure walls and on the platform will match shock isolators.

B. All lighting fixtures, not attached to shock isolated platform, will be provided with tension spring hangers.

C. All system interconnections will be flexible to shock-isolated equipment/components as follows:

1. All interconnections of hard-mounted environmental ductwork and shock-isolated equipment will be flexible duct/connector type.

(Continued)

II. C. (Continued)

2. All interconnection of hard-mounted electrical transmission media and shock-isolated Equipment/Electrical Panels will be flexible conduit type.

3. All interconnection of hard-mounted fluid transmission media and shock-isolated equipment will be flexible hose type.

D. The Shock Attenuation System will consist of the following equipment:

1. Structural mounting platform.

2. Shock mounting for hard-mounted lighting fixtures.

3. Flexible ducts and connections.

4. Flexible conduit and connections.

5. Flexible hose and connections.

NOTE

This Figure "A" is similar to Figure "A" 1441.3 except for changes required to meet the new weapons effect criteria and deletion of shock isolators.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A MAINTENANCE GROUND EQUIPMENT	B SM-80 WEAPON SYSTEM	C MISSILE	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	11/30/2	CONTRACT NO.
E 42(0	F LADDER, ACCESS LAUNCH FACILITY	G	J AFBSD APP DATE	12/27/2	K AF04(·94)-2··

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
	A		12/27/2																	RPIE	P1		W-(	3.8.1 3.39.1

I. TECHNICAL REQUIREMENTS

Access to ladder which starts below the top of the entrance must be provided. This equipment must provide a means of attachment to the lower portion of the access ladder and to the apron. It must extend above the hatch opening sufficiently to allow personnel to grip the device prior to descent. It must be easily removable from the Launcher entrance so it may be stored in the Launcher Support Building.

II. RECOMMENDED SOLUTION

It is recommended that a portable, lightweight section of the ladder be provided to satisfy this requirement. Fixtures for attaching this ladder to the apron and to the lower portion of the access ladder will be provided. Provisions for storage of this section of ladder at the Launcher Support Building shall be made.

NOTE: This Figure A is identical to Figure A 4260 Revision D

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	2-14-63	CONTRACT NO.
E 5003	F	G BLAST DOOR INSTALLATION, LCEB	J AFBSD APP DATE	4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCP. 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63						1					3						RPIE			W-6	2.53, 2.14

1. TECHNICAL REQUIREMENTS

A. Functional Requirements

A blast resistant closure is required at the LCEB entry for protection of weapon system equipment located in the LCEB from all normal and induced environmental effects and to permit free passage for equipment and personnel.

B. Design Constraints

1. Not applicable.

2. Physical

a. The blast door will swing out from the blast door frame to provide a clear opening for the maximum equipment envelope.
b. The blast door will have a blast resistant latching mechanism.

3. Interface

a. The blast door installation will interface with the LCEB hardened structure.

(Continued)

I. B. 3. (Continued)

b. The blast door installation will interface with the LCEB structures grounding.
c. The blast door position status will interface with security and monitoring.

4. Environment

a. Ambient

(1) The blast door installation will have an environmental seal to prevent deterioration of the LCEB environment from exterior water seepage and dust.
(2) The blast door installation will resist all degrading effects of climatic conditions.

See D2-30082.

b. Dynamic

(1) The blast door installation will be capable of resisting ground shock in all planes and blast pressures on exposed surfaces, individually or simultaneously, and follow-up vacuum effects per D2-30082.
(2) The blast door installation will provide a seal to prevent blast pressure leakage into LCEB.

See D2-30082.

5. Weapon Effects

a. Ground Shock and Blast Pressures

See Response Spectra D2-30082.

6. Monitoring

Status of LCEB blast door shall be displayed in the LCC.

7. Operating Life

See D2-30082.

(Continued)

I. B. (Continued)

8. Safety Considerations

Not applicable.

9. Special Considerations

a. For finishes see D2-30082.
b. Door shall open and close upon application of a manual force.

C. Operability and Maintainability

Maintenance/emergency provision for actuation or repair of blast door locking mechanism will be provided on the outside of the LCEB.

See D2-30082.

D. Reliability

E. Applicable Documents

D2-30082 Facilities Criteria for WS-133B Launch Control Facility, Operational.

II. RECOMMENDED SOLUTION

The LCEB entry will consist of a recessed door frame with a hinged door to close against an environmental seal. The blast door installation will effectively resist all normal and induced environmental effects.

A. The following particulars define the blast door installation:

1. The opening into the LCEB will be 60 inches by 96 inches.

(Continued)

II. A. (Continued)

2. The blast door frame will be of welded steel plate, anchored integral with the LCEB concrete structure and independent of tunnel floor level.

3. The blast door will be an enclosed welded steel structure and will be hinged vertically to swing horizontally outward from the LCEB.

4. The hinges will be fabricated of steel and secured to the door frame. The vertical load of the door will be supported by thrust bearings. The hinge pins will rotate in bearings. The hinge point will be located to provide full open access when the door is rotated through an angle of 100 degrees. The hinge design will permit opening and closing of door upon application of a manual force.

5. Exterior contamination and blast pressure leakage will be excluded by an environmental seal bonded to the door and compressed against the door frame bearing plates.

6. The blast door will be locked by means of hardened steel lock pins chamfered for easy entry into mating receptacles in the door. The lock pins will be capable of adjustable alignment.

7. The lock pins will be actuated by a hydraulic unit mounted on the outer face of the door and provided with a security cover plate. Egress actuation will be by manual control from inside the LCEB.

8. The blast door installation will be provided with copper grounding straps.

B. The blast door installation consists of the following major items of equipment:

1. Blast door frame, welded steel structure, wall brackets and anchors.
2. Blast door welded steel structure.
3. Environment seal.
4. Blast door hinge, mounting attachment, hinge pins and thrust bearings.
5. Hydraulic unit, piping, controls and security cover plate.
6. Copper grounding straps.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	CONTRACT NO.
E 5004	F	G BLAST DOOR INSTALLATION, LEB	2-14-63	
			J AFBSD APP DATE 4-11-63	K AF 04(694)-266

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LF 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	2.58.3.4

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A blast-resistant closure is required at the LEB entry to protect the weapon system equipment located in the LEB from all normal and induced environmental effects, and to permit free passage of personnel and equipment.

B. Design Constraints

1. Power

Not applicable.

2. Physical

a. The blast door will swing out from blast door frame to provide a minimum clear opening for the maximum equipment envelope (see D2-30081).
b. Manual control will be provided for operation of blast door from either side.

3. Interface

a. Blast door frame will interface with LEB hardened structure.
b. Blast door installation will interface with LEB structures ground.

(Continued)

I. B. (Continued)

4. <u>Environment</u>

a. <u>Ambient</u>

(1) Blast door installation will resist all degrading effects of climatic conditions (see D2-30081).
(2) Blast door installation will be provided with a seal to prevent entry of exterior contaminants into the LEB environment.

b. <u>Dynamic</u>

(1) The blast door installation will be capable of resisting ground shock in all planes and blast pressures, individually or simultaneously, and followup vacuum effects.
(2) Blast door installation will be provided with a seal to prevent deterioration of the LEB environment from the effects of thermal radiation or blast pressure leakage (see D2-30081).

5. <u>Weapon Effects</u>

Ground shock and blast pressures (see Response Spectra D2-30081).

6. <u>Monitoring</u>

Not applicable.

7. <u>Operating Life</u>

See D2-30081.

8. <u>Safety Considerations</u>

Not applicable.

9. <u>Special Considerations</u>

For finishes, see D2-30081.

(Continued)

I. (Continued)

C. Operability and Maintainability

See D2-30081.

D. Reliability

E. Applicable Documents

D2-30081, Facilities Criteria for WS-133B Launch Facility, Operational.

II. RECOMMENDED SOLUTION

The LEB entry will consist of a recessed door frame with a hinged door to close against an environmental seal. The door will be secured to the door frame by a manual locking mechanism. The blast door installation will effectively resist all normal and induced environmental effects.

A. The following particulars define the blast door installation:

1. The opening into the LEB will be 60 by 96 inches.

2. The blast door frame will be of welded steel plate anchored integral with the LEB concrete structure and independent of access shaft floor.

3. The blast door will be an enclosed welded steel structure and will be hinged vertically to swing horizontally outward from the LEB.

4. The hinges will be fabricated of steel and secured to the door frame. The vertical load of the door will be supported by thrust bearings. The hinge pins will rotate in bearings. The hinge point will be located to provide full open access when the door is rotated through an angle of 100 degrees. The hinge design will permit opening and closing door upon an initial manual force of 25 pounds and a sustaining force of 10 pounds.

(Continued)

II. A. (Continued)

5. Exterior contamination and blast pressure leakage will be excluded by an environmental seal bonded to the door and compressed against the door frame bearing plates.

6. The blast door will be manually secured from either side..

7. The blast door installation will be provided with copper grounding straps.

B. The blast door installation consists of the following equipment:

1. Blast door frame, welded steel structure, wall brackets and anchors.

2. Blast door, welded steel structure.

3. Environmental seal.

4. Hinge, hinge pins, bearings, mounting attachments.

5. Manual locking mechanism.

6. Grounding straps.

TYPE OF LIST	MODEL DESIGNATION	SUB SYSTEM IDENTIFICATION	CONTRACTOR
A REAL PROPERTY INSTALLED EQUIPMENT	B SM-80 WEAPON SYSTEM	C ENVIRONMENT	D THE BOEING COMPANY

FIGURE A NUMBER	MILITARY NOMENCLATURE AND FED. MFR'S CODE	COMMON NOMENCLATURE	H ORIGINATION DATE	J AFBSD APP DATE	CONTRACT NO.
E 5005	F	G VENTILATION SYSTEM, LEB	2-14-63	4-11-63	K AF 04(694)-256

L REVISIONS: REVISION DATE 1	CODE 2	INITIATED BY 3	AFBSD APPROVAL DATE 4	M FUNCTIONAL CLASS INDEX	N STOCK NUMBER: FED. SUPPLY CLASS 1	FEDERAL ITEM ID NUMBER 2	MANUFACTURER'S PART NUMBER 3	P BASIS OF ISSUE AND QUOTA ALLOCATIONS: LP 1	LCF 2	MLCC 3	SMSB 4	SRA 5	MAMS 6	VAFB 7	8	Q TOTAL ON ORDER	R ESTIMATED UNIT PRICE	S ESTIMATED TOTAL PRICE	T COGN. LAB CENTER & SERVICE	U PROPOSED SOURCE OF SUPPLY	V SOURCE CODE	W EST. PROD. LEAD TIME	X END ITEM EFFECTIVITY	Y REMARKS
2-22-63	6A	STL Review	4-11-63					1						6						RPIE			W-6	2.58.5.1 2.58.5.2 2.58.5.3 2.58.5.4 2.58.5.5 2.58.5.6

I. TECHNICAL REQUIREMENTS

A. Functional Requirements

A requirement exists to control the LEB room temperature and to support the Ambient Atmospheric Environment Control System, LF (Figure "A" 1211).

1. Provide a Ventilating System to meet the following requirements:

a. An automatically controlled fresh air supply is required for the LEB equipment area to maintain equipment operating efficiency. Fresh air shall be supplied to the equipment area to maintain room temperature between 40 deg F and 122 deg F. A minimum 12 cfm of fresh air shall be supplied at all times for the Ambient Atmospheric Environment Control System requirements (Figure "A" 1211).

b. A sufficient volume of fresh air is required to support the following diesel engine operations.

(1) Engine combustion.

(2) Engine cooling. Efficient engine operation requires that air supply shall be automatically controlled when set is running to maintain jacket water temperature at 180 deg F.

2. A means shall be provided for expelling diesel engine exhaust gases to the outside atmosphere. Provide protection for exhaust system against shock and expansion. Protection is required to prevent excessive heat gain in equipment area.

3. A requirement exists to provide air intake and exhaust plenums to supply fresh outside air to meet the requirements of the Environmental Control System (Figure "A" 1211). The lower ends of the plenums shall be sized to accommodate blast-induced debris in the

(Continued)

I. A. 3. (Continued)

amounts anticipated, without restricting airflow. A means is required to delay blast pressure transmission to the LEB to permit full closure of the blast valves.

B. Design Constraints

1. Power

2. Physical

Not applicable.

3. Interface

a. Ambient Atmospheric Environment Control System (Figure "A" 1211).
b. Electrical System, LF (Figure "A" 1329).
c. Shock Attenuation System, LEB (Figure "A" 1441).
d. Security System, LF (Figure "A" 1331).

4. Environmental

a. Ambient

(1) Natural climatic environments (see BSD Exhibit 62-80).
(2) Controlled environmental is from 40 deg F minimum to 122 deg F maximum.
(3) Maximum temperatures in the exhaust ducting will be 250 deg F and in the diesel exhaust piping will be 1000 deg F.

b. Dynamic

For dynamic environment, see D2-30081.

5. Weapons Effects

Refer to Paragraph 4b above.

6. Monitoring

The position of the plenum gratings shall be monitored.

(Continued)

I. B. (Continued)

7. Operating Life

The system is designed for a life of 10 years, allowing for routine servicing and replacement of parts.

8. Safety Considerations

Refer to BSD Exhibit 62-79.

9. Special Considerations

Design of the inlet and outlet ducts shall take into consideration the possibilities of an air hammer generated by rapid closure of the blast valves.

C. Operability and Maintainability

Equipment shall be located for ease of inspection, cleaning, and maintenance with minimum disassembly or removal of other equipment. Ladders are required in the intake and exhaust plenums to facilitate periodic cleanout.

D. Reliability

E. Applicable Documents

1. BSD Exhibit 62-80 Design Criteria for Minuteman WS-133B Environmental Control Systems.
2. D2-30081 Facilities Criteria for WS-133B Launch Facility, Operational.
3. BSD Exhibit 62-79 Life Support Criteria.

II. RECOMMENDED SOLUTION

A. A duct, sized to transmit approximately 12,000 cfm of air, will be installed under the shock platform floor. It will connect the Ambient Atmospheric Environment Control System refrigeration unit plenum (Figure "A" 1211) to the diesel plenum. It will convey condenser air and condenser bypass air from the

(Continued)

II. A. (Continued)

refrigeration unit plenum to the diesel engine plenum. The transition duct, which connects the two plenums, will be provided with openings to supply a minimum of 12 cfm at all times for the Ambient Atmospheric Environment Control System requirements and a maximum 12,000 cfm of air to the equipment area. A motor controlled modulating damper will be installed in the transition duct upstream from the diesel plenum. The diesel plenum will be sized to fit the engine radiator and will transmit, through the diesel radiator, a minimum 12 cfm and a maximum 12,000 cfm (approximately) of air from the equipment room to the exhaust duct and fan (Figure "A" 1211). A motor controlled modulating damper will be installed in the diesel plenum. The transition duct and diesel plenum modulating dampers will be operated by a single damper motor to bypass or supply air as demand requires for efficient engine operation or area temperature control.

A three-way solenoid air valve will be installed for control of diesel plenum and transition duct modulating dampers as follows:

1. When the diesel engine stops, the solenoid valve is deenergized, closing the pneumatic air port to the jacket water thermostat and opening the port to the room thermostat. When the room temperature is below 70 deg F, the transition duct modulating damper will be open and the diesel plenum modulating damper will be closed providing the LEB equipment area with minimum air supply. When room temperature rises to 70 deg F, the room thermostat will modulate the transition duct modulating damper toward closed and the diesel plenum modulating damper toward open, providing increased quantities of outside air to the equipment area to maintain room temperature as near 70 deg F as entering air temperature will permit. 12 cfm of fresh air will be supplied to the equipment area at all times to provide makeup air for the Ambient Atmospheric Environment Control System, LF (Figure "A" 1211).

   Fresh air will be supplied the LEB equipment area by the supply and exhaust fans to be provided as part of the Ambient Atmospheric Environment Control System, LF (Figure "A" 1211).

   Control air for damper operation will be supplied by the instrument air compressor (Figure "A" 1211). Control air piping will be installed on the underside of the shock-mounted floor, running from the damper operators and associated equipment to the location of the air compressor (Figure "A" 1211).

2. When the diesel engine starts, the solenoid valve is energized, closing the pneumatic air port to the room thermostat and opening the port to the diesel engine jacket water thermostat. The diesel plenum and transition duct modulating dampers will be modulated to maintain 180 deg F jacket water temperature when set is running. An airflow of approximately 12,000 cfm will be supplied for engine cooling at maximum room temperature of 122 deg F.

   A maximum 600 cfm of air will be supplied for engine combustion.

(Continued)

II. (Continued)

B. An exhaust pipe will be installed to expel engine combustion gases to the atmosphere. The pipe will be connected from the diesel engine to the exhaust duct downstream from the exhaust fan (Figure "A" 1211). Flexible high temperature connections will connect the exhaust pipe to the engine and the exhaust duct to provide sufficient flexibility to withstand shock-induced vibration and/or expansion. Asbestos insulation will be installed around the exhaust pipe to prevent excessive heat gain in the equipment room.

C. Structural plenums will be provided to supply and exhaust air between the LCEB and Grade Level. The plenums will be provided with gratings, at Grade Level, which will be furnished with locking devices. A suitably sized debris pit will be provided at the lower end of each plenum and a structurally embedded ladder will be provided, from Grade to permit periodic cleanout. A pressure delay route will be provided in the design of the air path to permit full closure of the blast valves before overpressure reaches the LEB. The delay path will be pitched to permit drainage into the debris pit.

D. The system will contain the following equipment:

1. Modulating dampers with a pneumatically-operated damper motor.
2. Room thermostat, pneumatic.
3. Immersion thermostat, pneumatic, diesel water jacket.
4. Solenoid air valve, three-way.
5. Ducting and plenum.
6. Control air piping.
7. Piping and insulation.